

REGIONAL STRATEGY AND PLAN OF ACTION for

# Measles and Rubella Elimination in the Western Pacific





# **Regional Strategy and Plan of Action for Measles and Rubella Elimination in the Western Pacific**



**World Health  
Organization**

**Western Pacific Region**

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# FOREWORD

I am pleased to present the *Regional Strategy and Plan of Action for Measles and Rubella Elimination in the Western Pacific*. Measles and rubella are serious diseases targeted for elimination in the Western Pacific Region, principally through the use of a highly effective and safe combined vaccine.

Since 2003 when the Regional Committee resolved to eliminate measles, the Region has succeeded in dramatically reducing measles morbidity and mortality through improving access to and utilization of measles-containing vaccine, strengthening immunization programmes and establishing surveillance systems and laboratory networks. However, a regional resurgence of measles from 2013 to 2016 revealed the need to better address a number of challenges not fully covered by existing strategic and guidelines documents.

In 2015, the Technical Advisory Group for Immunization and Vaccine-Preventable Diseases in the Western Pacific Region recommended that WHO update the *Western Pacific Regional Plan of Action for Measles Elimination (2003)* to include strategies for rubella elimination and guide Member States in developing new national plans to accelerate, achieve and sustain measles and rubella elimination. After a consultative development process, the Regional Committee endorsed the *Regional Strategy and Plan of Action for Measles and Rubella Elimination in the Western Pacific* in October 2017.

This new strategy and plan of action identifies a range of actions to better address remaining challenges for measles and rubella elimination in the Western Pacific Region. The strategy and plan of action is designed to be easily adapted for development of national plans of action for achieving and sustaining measles and rubella elimination, tailored to the specific strengths, challenges and issues faced by Member States. Recent experience in the Region has shown that to achieve measles and rubella elimination will require a shared effort across the Region to strengthen the ability of health systems to achieve and sustain high immunity to measles and rubella across the whole population, and strong systems exist to prevent, detect and respond to outbreaks.

With this new approach and renewed commitment, I am confident we can reach our shared goal of eliminating these two devastating, but preventable diseases from the Region.



Shin Young-soo, MD, Ph.D.  
Regional Director

## ABBREVIATIONS

<b>AFR</b>	acute fever and rash
<b>AEFI</b>	adverse event following immunization
<b>CCDC</b>	Chinese Center for Disease Control and Prevention
<b>CRS</b>	congenital rubella syndrome
<b>DQS</b>	data quality self-assessment
<b>ELISA</b>	enzyme-linked immunosorbent assay
<b>EPI</b>	Expanded Programme on Immunization
<b>GSL</b>	global specialized laboratory
<b>IgG</b>	immunoglobulin G
<b>IgM</b>	immunoglobulin M
<b>IEC</b>	information, education and communications
<b>IPV</b>	inactivated poliovirus vaccine
<b>IU</b>	international units
<b>JRF</b>	Joint Reporting Form
<b>LabNet</b>	laboratory network
<b>LQAS</b>	lot quality assurance sampling
<b>MCV</b>	measles-containing vaccine
<b>MCV1</b>	first dose of measles-containing vaccine
<b>MCV2</b>	second dose of measles-containing vaccine
<b>MMR</b>	measles, mumps and rubella (vaccine)
<b>MMRV</b>	measles, mumps, rubella and varicella vaccine
<b>MNTE</b>	maternal and neonatal tetanus elimination
<b>MRCV</b>	measles- and rubella-containing vaccine
<b>MRCV1</b>	first dose of measles- and rubella-containing vaccine
<b>MRCV2</b>	second dose of measles- and rubella-containing vaccine
<b>MRI</b>	Measles and Rubella Initiative
<b>MR</b>	measles-rubella (vaccine)
<b>MV</b>	monovalent measles vaccine
<b>NMRL</b>	national measles-rubella laboratory
<b>NVC</b>	national verification committee
<b>OPV</b>	oral poliovirus vaccine
<b>PAHO</b>	Pan American Health Organization
<b>PPP</b>	public–private partnership
<b>PT</b>	proficiency testing
<b>RCA</b>	rapid coverage assessment
<b>RCV</b>	rubella-containing vaccine
<b>RED/REC</b>	Reach Every District/Reaching Every Community
<b>RRL</b>	regional reference laboratory
<b>RT-PCR</b>	reverse transcription polymerase chain reaction
<b>RVC</b>	Regional Verification Commission for Measles Elimination
<b>SSPE</b>	subacute sclerosing panencephalitis
<b>SIA</b>	supplementary immunization activity
<b>SOP</b>	standard operating procedure
<b>SRVC</b>	Subregional Verification Committee
<b>TAG</b>	Technical Advisory Group
<b>UNICEF</b>	United Nations Children’s Fund
<b>WHO</b>	World Health Organization

# EXECUTIVE SUMMARY

Measles is a highly contagious, serious and sometimes fatal viral disease. In developing countries, measles infection runs a devastating course in children and mortality rates can range from 2% to 15%. Rubella is usually a mild viral disease in children, but infection in a pregnant woman can have serious consequences on the developing fetus. Congenital rubella syndrome (CRS) occurs in 90% of cases of rubella infection early in pregnancy. Miscarriage or stillbirth can occur, and babies born with CRS can suffer from a range of problems that include ophthalmic, auditory, cardiologic and craniofacial defects, as well as mental retardation.

In 2003, the World Health Organization (WHO) Regional Committee for the Western Pacific decided that measles elimination should be one of the pillars to strengthen immunization programmes. It urged Member States to offer all children two doses of measles vaccine to achieve 95% population immunity for each birth cohort in every district. In 2005, the Regional Committee resolved that the Region should aim by 2012 to eliminate measles and urged Member States to develop or strengthen national plans for measles elimination. The Regional Committee reaffirmed its commitment in 2012 to eliminate measles and urged Member States to interrupt all residual endemic measles virus transmission as rapidly as possible by ensuring high population immunity with measles vaccine. In 2014, the Regional Committee endorsed the *Regional Framework for Implementation of the Global Vaccine Action Plan in the Western Pacific* and its specified immunization goals, which include regional rubella elimination – but without setting a target date.

Elimination of measles and rubella in the Western Pacific Region is an important public health goal. Elimination will save lives and save resources by preventing morbidity and mortality due to complications of measles, rubella and CRS. Investments in this goal can and should be leveraged as a platform to broadly strengthen immunization programmes and overall health systems and deliver other key health interventions, such as Vitamin A supplementation, growth monitoring and deworming. Application of this so-called “diagonal approach”, which includes strengthening overall immunization systems and health systems, is critical for the achievement and the sustainability of measles and rubella elimination. In addition, progress towards measles and rubella elimination can serve as a useful overall indicator of programme quality and help guide public health interventions and achieve equitable access to immunization and health services. Due to the highly infectious nature of measles and the high severity of CRS, outbreaks of these diseases are highly visible, result in public demand for interventions, highlight areas of public health system weakness to be strengthened, and draw needed attention to special populations likely to be missed by other public health activities.

All countries and areas in the Western Pacific Region have carried out the strategies and activities for measles elimination outlined in the *Western Pacific Regional Plan of Action for Measles Elimination*, which was endorsed by the Regional Committee for the Western Pacific in 2003 and detailed in the *Field Guidelines for Measles Elimination*, published in 2004 by the WHO Regional Office for the Western Pacific. As a result, countries and areas in the Region strengthened their national immunization programmes and significantly reduced measles transmission, morbidity and mortality. In 2012, the Region recorded the lowest number of measles cases and incidence rate in its history – 10 794 cases, or 5.9 cases per 1 million population, compared with 177 265 cases, or 105.2 cases per 1 million population in 2000.

Despite these achievements, the Western Pacific experienced a Region-wide measles resurgence from 2013 to 2016. The regional measles incidence rate per 1 million population increased from 5.9 in 2012 to 19.5 in 2013, 70.1 in 2014, 30.6 in 2015 and 30.1 in 2016. While the regional measles resurgence in 2013–2016 hampered the Region from achieving its elimination goal, detailed epidemiological analysis helped identify previously unarticulated issues and emerging challenges that need to be addressed urgently to achieve and sustain measles and rubella elimination in all countries and areas in the Western Pacific Region.

In June 2015, the Technical Advisory Group (TAG) for Immunization and Vaccine-Preventable Diseases in the Western Pacific Region recommended that WHO update the *Western Pacific Regional Plan of Action for Measles Elimination* with strategies for rubella elimination and support Member States as they develop or update national plans to accelerate activities for both measles and rubella elimination. In response to the recommendation of the TAG, this document, *Regional Strategy and Plan of Action for Measles and Rubella Elimination in the Western Pacific*, was developed over 15 months in close consultation with Member States, experts and partner agencies. As both a strategy and a plan of action, it provides more detailed technical guidance on measles and rubella. This document was endorsed by Member States during the sixty-eighth session of the Regional Committee in 2017.

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**THE FIRST AIM** of this Regional Strategy and Plan of Action is to propose operational targets for 2020 to attain the regional goal, which is to achieve and sustain elimination of measles and rubella – interruption of the transmission of measles and rubella viruses – in all countries and areas of the Western Pacific Region.

*For measles elimination, the proposed operational targets to be completed by 2020 are:*

1. to prevent resurgence of endemic measles virus transmission (genotype B3, D8, D9 and H1);
2. to interrupt all ongoing measles transmission in endemic countries;
3. to achieve interruption of measles virus transmission in countries and areas approaching measles elimination;
4. to sustain interruption of measles virus transmission in countries and areas having reached measles elimination;
5. to prevent large-scale outbreaks after importation; and
6. to establish and maintain verification-standard measles surveillance supported by WHO accredited laboratories in all countries and areas of the Region.

*For rubella elimination, the proposed operational targets to be completed by 2020 are:*

1. to develop regional verification guidelines for rubella elimination (by 2018);
2. to set a national target year for rubella elimination in all countries;
3. to develop national strategies and plans of action for rubella elimination in all countries; and
4. to establish CRS surveillance in all countries.

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**THE SECOND AIM** of this Regional Strategy and Plan of Action is to propose strategies and activities to address and overcome unresolved issues and emerging challenges identified during the regional measles resurgence and to achieve the proposed operational targets by 2020. In total, 31 strategies with accompanying activities are proposed in eight strategic areas:

1. overall planning and the immunization system;
2. immunization;
3. epidemiologic surveillance;
4. laboratory support;

5. programme review and risk assessment;
6. outbreak preparedness and response;
7. partnership, advocacy, information, education and communications (IEC), and social mobilization; and
8. progress monitoring and verification of elimination.

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**THE THIRD AIM** of this Regional Strategy and Plan of Action is to provide a framework (Appendix 6) for countries and areas in the Region to use when they develop or update national plans to accelerate activities for both measles and rubella elimination to achieve the proposed operational targets by 2020. The Western Pacific Region is comprised of Member States with a wide range of demographics, economic development, epidemiologic characteristics, and progress towards measles and rubella elimination. Therefore, guided by an analysis of their respective situation, each country and area is suggested to choose suitable strategies and activities to address country- or area-specific issues and challenges in order to reach the 2020 targets.



## BACKGROUND

Measles is a highly contagious and serious disease caused by a virus. The virus is capable of finding remaining susceptible persons and can circulate wherever a relatively large number of susceptible people congregate, even in the face of a low population-susceptibility rate. Measles can be fatal. In developing countries, measles infection runs a devastating course in children and the mortality rates can be as high as 2–15%.

Rubella is usually a mild viral disease in children, but infection in a pregnant woman can be devastating to the fetus. Congenital rubella syndrome (CRS) occurs in 90% of cases of rubella infection in early pregnancy. Miscarriage or stillbirth can occur, and babies born with CRS can suffer from range of problems, including ophthalmic, cardiac, auditory and craniofacial defects, and mental retardation.

There is no specific treatment for either measles or rubella. However, there are effective, safe and inexpensive vaccines for both that can protect individuals, families and communities.

This section describes characteristics of both diseases (Chapter 1), discusses public health intervention options for them, namely “control” versus “elimination”, with clarification of what measles and rubella elimination is (Chapter 2), and discusses why the Western Pacific Region should aim to eliminate both measles and rubella (Chapter 3).

# 1. Diseases

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## 1.1 MEASLES

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### *Infectious agent, transmission and communicability*

Measles virus is a member of the genus *Morbilivirus* of the *Paramyxoviridae* family. The virus appears to be antigenically stable – there is no evidence that the viral antigens have significantly changed over time. However, sequence analysis of viral genes has shown that there are distinct lineages (genotypes) of wild-type measles viruses (1). The World Health Organization (WHO) recognizes 24 genotypes of wild-type measles virus (A, B1, B2, B3, C1, C2, D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, D11, E, F, G1, G2, G3, H1 and H2) (2). When considered along with epidemiological information, identification of a specific virus genotype can suggest the geographic origin of an outbreak (1).<sup>1</sup>

Humans are the only natural hosts of measles virus. Measles virus can only be maintained in human populations by an unbroken chain of acute infections (3). People with measles are infectious for several days before and after the onset of a rash, when the symptoms of cough, coryza and sneezing are most severe. These symptoms facilitate the spread of the virus, and the fact that measles virus is contagious before the onset of recognizable disease hinders the effectiveness of quarantine measures (3). Measles is transmitted primarily from person to person by large respiratory droplets, but it also can be spread by the airborne route as aerosolized droplet nuclei. The period of maximal contagion occurs during the prodrome (3).

Measles virus is one of the most highly contagious human pathogens and is very capable of seeking out the small number of remaining measles-susceptible persons. Secondary attack rates among susceptible household contacts have been reported to be 75–90%. Due to the high transmission efficiency of measles, outbreaks have been reported in populations where only 3–7% of the individuals were susceptible (1, 2). There is neither latent nor persistent infection with measles virus resulting in prolonged contagiousness (3).

### *Clinical features and diagnosis*

The incubation period is 10–14 days (range, 8–15 days) from exposure to onset of rash, and patients are contagious from about four days before appearance of the rash until four days

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1. Currently circulating virus genotypes in the Western Pacific Region include measles B3, D8, D9 and H1.

after appearance. Towards the end of the incubation period, patients develop prodromal symptoms of high fever, cough, coryza and conjunctivitis. The typical maculopapular rash appears after another three to four days, often accompanied by a fever that peaks at 39–40 °C. At the onset of rash, bluish-white Koplik's spots, which are pathognomonic of measles, may be seen in the oral mucosa. Patients normally improve by the third day after rash onset and are fully recovered seven to 10 days after onset of the disease (4).

Measles may occur in individuals who receive serum immunoglobulin following measles exposure, who have waning maternal immunity or who receive post-exposure immunization. They may present with a milder "modified" form of measles, less pronounced signs and symptoms and a prolonged incubation period of up to 21 days. These individuals are still infectious and may therefore be undetected sources of measles transmission during outbreaks.

Many illnesses are accompanied by fever, rash and a variety of non-specific symptoms. In examining for measles, it is important to consider rubella, scarlet fever, exanthema subitum (roseola), dengue fever and the early stages of chickenpox in the differential diagnosis. Moreover, there are other conditions that may present in a similar form, including erythema infectiosum (fifth disease), enterovirus or adenovirus infections, Kawasaki's disease, toxic shock syndrome, rickettsial diseases and drug hypersensitivity reactions (1).

Measles may be readily diagnosed by clinicians familiar with the disease, particularly during outbreaks. Koplik's spots may be helpful because they appear before the rash and are pathognomonic. However, clinical diagnosis is difficult in countries where the incidence of measles is low because other pathogens are responsible for most illnesses with presenting symptoms of fever and rash (3). In addition, "modified measles" symptoms may be difficult to recognize due to milder or subclinical signs and symptoms, posing a challenge for surveillance.

Serology is the most common method of laboratory confirmation. The detection of measles virus-specific immunoglobulin M (IgM) in a specimen of serum or oral fluid is deemed diagnostic of acute infection and is the most commonly used serological test (3). Both IgM and immunoglobulin G (IgG) antibodies are produced during the primary immune response and can be detected in the serum within a few days of rash onset. Using sensitive enzyme-linked immunosorbent assay (ELISA) IgM assays, 90% of measles cases are IgM positive at three days post rash onset (4). IgM antibody levels peak after about seven to 10 days and then decline rapidly, being rarely detectable after six to eight weeks. IgG antibody levels peak within about four weeks and persist long after infection. Molecular detection methods, including real-time reverse transcription polymerase chain reaction (RT-PCR), conventional RT-PCR, virus isolation, IgG antibody titre detection in acute and convalescent serum samples or IgG avidity testing, can also serve as alternative methods of laboratory confirmation.

## Complications

Measles is one of the most devastating infectious diseases of humans – measles was responsible for millions of deaths annually worldwide before the introduction of measles vaccines (3). In industrialized countries, deaths from measles are rare, although severe forms of the disease and even death may occur in previously healthy individuals (5). The most commonly cited complications associated with measles infection are otitis media (7–9%), pneumonia (1–6%), diarrhoea (8%), post-infectious encephalitis (1 per 1000–2000 cases of measles), subacute sclerosing panencephalitis (SSPE) (1 per 100 000 cases) and death (1.0–3.0 per 1000 cases). The risk of serious complications and death is increased in children younger than 5 years and adults older than 20 years. Pneumonia, which is responsible for approximately 60% of deaths, is more common in young patients whereas acute encephalitis occurs more frequently in adults. Pneumonia may occur as a primary viral pneumonia (Hecht pneumonia) or as a bacterial superinfection, most commonly with staphylococcus, pneumococcus or typable (encapsulated) *Haemophilus influenzae*. Other described complications include thrombocytopenia, laryngotracheobronchitis, stomatitis, hepatitis, appendicitis and ileocolitis, pericarditis and myocarditis, glomerulonephritis, hypocalcaemia and Stevens-Johnson syndrome (2).

In developing countries, measles infection runs a devastating course in children and the mortality rates can be as high as 2–15% (2). Pneumonia is the most common severe complication from measles and is associated with the greatest number of measles-associated deaths. The rash is intense and often haemorrhagic (black measles) and it resolves after marked desquamation. Inflammation of the mucosa leads to stomatitis and diarrhoea. Diarrhoea is a frequent cause of death because it may persist long after the acute insult and further aggravate a pre-existing malnourished state. The combination of Vitamin A deficiency and keratitis results in a high incidence of blindness. Secondary bacterial infections can occur, often with staphylococci, produce pustules, furuncles, pneumonia, osteomyelitis and other pyogenic complications. Young age at infection contributes to the high risk of serious complications and death. Malnutrition, especially Vitamin A deficiency, may be an important factor leading to the marked severity of measles in the developing world because of defects in cellular (and possibly humoral) immunity. Measles is also responsible for much diarrhoea, respiratory disease and blindness in the developing world (2).

## Epidemiology

In the absence of an immunization programme, measles is a ubiquitous and seasonal disease affecting nearly every person in a given population by adolescence (2). After the introduction of measles vaccine during the 1960s, countries that had achieved high vaccine coverage experienced a 98% or greater reduction in the number of reported cases (1). Moderate-to-high vaccination coverage may reduce or eventually interrupt measles transmission for a period of time, resulting in low numbers of cases for a few

years. However, with only moderate-to-high vaccination coverage, there will eventually be a large measles epidemic through the build-up of susceptible people (6).

In densely populated urban settings with low-to-moderate vaccination coverage, measles mainly affects infants and young children. As measles vaccination coverage increases, or population density decreases, the age distribution shifts towards older children. As vaccination coverage, and thus population immunity, increases further, the age distribution of cases might shift into adolescence and adulthood (3). Isolated populations, such as a population on an island, can remain free of infection for variable periods and then, after reintroduction of the virus, may experience epidemic disease that involves all age groups not affected by the last wave of infection. Thus, whereas peak transmission usually occurs among young children, outbreaks in isolated communities involve many older people (2).

### Treatment

There is no specific antiviral therapy for people with measles (3). Vitamin A should be used to mitigate the effects of complications of measles, such as corneal ulceration, by bolstering the immune system that is weakened by measles disease. Administration of vitamin A can result in a reduction in morbidity and mortality. WHO recommends administration of once-daily doses of 200 000 international units (IU) of vitamin A for two consecutive days to all children aged 12 months or older who were diagnosed to have been infected with measles. Lower doses are recommended for younger children: 100 000 IU per day for children aged 6–12 months and 50 000 IU per day for children younger than 6 months. In children with clinical evidence of vitamin A deficiency, a third dose is recommended two to four weeks later (3).

Secondary bacterial infections are a major cause of morbidity and mortality after measles, and effective case management involves prompt treatment with antibiotics. Antibiotics are indicated for people with measles who have clinical evidence of bacterial infection, including pneumonia and otitis media. *Streptococcus pneumoniae* and *Haemophilus influenzae* type b are common causes of bacterial pneumonia after measles, and vaccines against these pathogens will probably lower the incidence of secondary bacterial infections after measles infection (3).

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## 1.2 RUBELLA

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### *Infectious agent, transmission and communicability*

Rubella virus is a member of the genus *Rubivirus* of the *Togaviridae* family. There is only one serotype of rubella virus, two clades and at least three genotypes. Of rubella isolates collected between 2005 and 2010, three genotypes (1E, 1G and 2B) of the defined 13 genotypes had wide geographic distribution, whereas others occurred sporadically or were geographically restricted. The genetic differences between clades do not appear to translate into antigenic differences (1, 2).

Humans are the only natural hosts of rubella virus. Rubella virus is spread from person to person via the respiratory route, and the virus initially replicates in the nasopharyngeal mucosa and local lymph nodes. In pregnant women, the virus infects the placenta, spreads to the fetus and alters the function of many fetal systems by interfering with organ formation and causing systemic inflammation (2, 3). Infants with congenital rubella syndrome (CRS) shed large quantities of virus from body secretions for up to one year and can therefore transmit rubella to persons caring for them who are susceptible to the disease. Rubella may be transmitted by persons with subclinical or asymptomatic cases (up to 50% of all rubella virus infections) (4). Rubella virus can be found in nasopharyngeal samples from one week before the onset of the rash to two weeks after, with maximal shedding occurring one to five days after rash onset (2). Rubella is only moderately contagious. The disease is most contagious when the rash first appears, but virus may be shed from seven days before to five to seven days or more after rash onset (4).

### *Clinical features and diagnosis*

Symptoms are often mild, and up to 50% of infections may be subclinical or inapparent (4). The incubation period ranges from 12 to 23 days, with an average of 18 days (2). In the second week after exposure, lymphadenopathy may be noted, particularly occipital and postauricular, and virus cultures reveal rubella virus in the nasopharynx (1). During the second week after exposure, there may be a prodromal illness consisting of fever < 39.0 °C, malaise and mild conjunctivitis, which is more common in adults. The maculopapular, erythematous and often pruritic rash occurs in 50–80% of rubella-infected persons. Serological studies have shown that 20–50% of all rubella infections occur without a rash or are subclinical. The rash, usually lasting one to three days, starts on the face and neck before progressing down the body (2).

Clinical diagnosis of rubella is unreliable and should not be considered in assessing immune status. Because many rash illnesses may mimic rubella infection and many rubella infections are unrecognized, the only reliable evidence of previous rubella infection is the presence of serum rubella IgG antibody (4). Serological diagnosis depends on

the demonstration of the IgM antibody in the acute specimen, or a demonstration of a significant rise in IgG titer between acute and convalescent specimens. Isolation of virus can be accomplished from the blood and nasopharynx during the prodromal period and from the nasopharynx for as long as two weeks after eruption, although the likelihood of virus recovery is sharply reduced by day four after the rash onset (1).

### *Complications*

Although acquired rubella is thought of as a benign disease, arthralgia and arthritis commonly are observed in adults, particularly women (1). Arthralgia or arthritis may occur in up to 70% of adult women who contract rubella, but it is rare in children and adult males. Fingers, wrists and knees are often affected. Joint symptoms tend to occur about the same time or shortly after appearance of the rash and may last for up to one month; chronic arthritis is rare (4).

Post-infectious encephalitis occurs in approximately 1/6000 rubella cases, but occasionally incidences have been reported as high as 1/500 and 1/1600 (2). Haemorrhagic manifestations occur in approximately 1/3000 cases, occurring more often in children than in adults. These manifestations may be secondary to low platelets and vascular damage, with thrombocytopenic purpura being the most common manifestation. Gastrointestinal, cerebral or intrarenal haemorrhage may occur. Effects may last from days to months, and most patients recover (4).

### *Congenital rubella syndrome*

The public health importance of rubella is due mainly to the teratogenic potential of the virus. From just before conception and during the first eight to 10 weeks of gestation, rubella infection may cause multiple fetal defects in up to 90% of cases and may result in fetal wastage or stillbirth. Although the risk subsequently declines and fetal defects are rarely associated with maternal rubella after the 16th week of pregnancy, sensorineural hearing deficit may occur up to week 20 (2).

CRS can present with neonatal manifestations, including meningoencephalitis, hepatosplenomegaly, hepatitis, thrombocytopenia and radiolucencies in the long bones (a characteristic radiological pattern of CRS) (2). The defects associated with CRS are: ophthalmic (for example, cataracts, microphthalmia, glaucoma, pigmentary retinopathy, chorioretinitis); auditory (for example, sensorineural deafness); cardiac (for example, peripheral pulmonary artery stenosis, patent ductus arteriosus or ventricular septal defects); and craniofacial (for example, microcephaly). The complications of thrombocytopenia can be fatal. Interstitial pneumonitis may occur in infants with CRS (2).

Manifestations of CRS may be delayed from two to four years (4). Those that survive the neonatal period may face serious developmental disabilities (for example, visual

and hearing impairments) and have an increased risk for developmental delay, including autism, type I diabetes mellitus and thyroiditis. A progressive encephalopathy resembling SSPE has been rarely observed in patients with CRS (2).

### Epidemiology

Rubella usually occurs in a seasonal pattern, with epidemics every five to nine years. However, the extent and periodicity of rubella epidemics is highly variable in both industrialized and developing countries (2).

The highest risk of CRS is in countries with high rates of susceptibility to rubella among women of childbearing age. Before the introduction of rubella vaccine, the incidence of CRS varied from 0.1–0.2/1000 live births during endemic periods and from 0.8–4/1000 live births during rubella epidemics (2). The most complete analysis of CRS globally was performed by Vynnycky and Adams. They modelled the incidence of the disease in all WHO Member States for the years 1996 and 2010 and derived the estimate of 105 391 annual cases of CRS globally, although the confidence limits were wide, ranging from 53 605 to 158 041 cases (Table 1) (1).

**Table 1.** Estimated number of CRS cases by WHO region in 1996 and 2010

WHO REGION	1996		2010	
	Number	Range	Number	Range
– Africa	28 315	13 443–57 421	38 712	18 063–79 852
– Americas	10 640	4 394–19 867	< 1	0–136
– Eastern Mediterranean	7 625	2 577–15 290	5 294	827–12 358
– Europe	8 155	1 839–15 349	98	1–507
– South-East Asia	50 128	14 587–96 435	49 229	11 204–96 976
– Western Pacific	11 541	5 268–21 980	8 889	4 010–21 118
<b>GLOBAL</b>	<b>119 224</b>	<b>72 119–169 107</b>	<b>105 391</b>	<b>53 605–158 041</b>

Source: Vynnycky E et al. (5).

When vaccination of children is introduced, the average age of those infected shifts to older age groups; however, the age-specific incidence decreases in all age groups if vaccination coverage is high. Sustained low coverage of rubella immunization in infants and young children (for example, when rubella vaccine is used only in the private sector) can result in an increase in susceptibility among women of childbearing age that may increase the risk of CRS above levels prior to the vaccine being introduced – known as a paradoxical effect (2). Country experience and mathematical modelling suggest that to

avoid an increase in the risk of CRS, countries should achieve and maintain immunization coverage of 80% or greater with at least one dose of rubella-containing vaccine (RCV) delivered through routine services and regular supplementary immunization activities (3).

The herd immunity threshold has been estimated at between 85% and 91%. Hence, if vaccination programmes can achieve and maintain immunization coverage that results in sustained population immunity above this level, rubella can be eliminated. Rubella vaccination coverage through routine immunization programmes is almost identical to that of measles because all countries provide RCV combined with measles or measles and mumps vaccines. Rubella is less infectious when compared with measles, indicating that rubella eradication might be easier to achieve than measles eradication (2).

In light of the remaining global burden of CRS and proven efficacy and safety of RCVs, WHO recommends that countries take the opportunity offered by accelerated measles control and elimination activities to introduce RCVs. These measles vaccine delivery strategies provide an opportunity for synergy and a platform for advancing rubella and CRS elimination (1).

### Treatment

There is no specific treatment for either measles or rubella (6).

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## 1.3 PREVENTION OF MEASLES AND RUBELLA: VACCINES AND IMMUNIZATION

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There is no specific treatment for either measles or rubella (5). Prevention, particularly through immunization programmes with safe and effective vaccines against measles and rubella, is the most important measure to protect people, communities and populations from measles, rubella and CRS.

### Vaccines

A number of live, attenuated measles-containing vaccines (MCV) and rubella-containing vaccines (RCV) are available, either as monovalent vaccine (MV) or in combination: as measles- and rubella-containing vaccine (MRCV); measles, mumps and rubella (MMR) vaccine; or measles, mumps, rubella and varicella (MMRV) vaccine. Internationally available measles and rubella vaccines are safe, effective and may be used interchangeably within immunization programmes (1). The biologic significance of differences in the genetic sequence of wild-type strains is not known; the immune response generated through vaccination protects against all strains (2). The protective immune responses to each individual vaccine antigen, as well as vaccine-associated adverse events, are similar when MCV and RCV are administered as combined vaccines (for example, MRCV or MMRV vaccine) or simultaneously at different anatomical sites with other vaccines, such as diphtheria toxoid, tetanus toxoid, pertussis vaccine, *Haemophilus influenzae* type b vaccine, poliovirus vaccines (oral poliovirus vaccine [OPV] and/or inactivated poliovirus vaccine [IPV]) varicella vaccine, hepatitis B vaccine or heptavalent pneumococcal vaccine (1).

### Immunization

Vaccinating infants before or at the age of 6 months with MCV or RCV often fails to induce seroconversion due to the immaturity of the immune system as well as the presence of neutralizing maternal antibodies. For MCV, the median proportion of infants who seroconvert after receiving one dose at 8–9 months of age is 89.6% (interquartile range, 82–95%); if vaccinated with MCV at age 11–12 months, the median proportion of infants who seroconvert is 99% (interquartile range, 93–100%). Almost all develop immunity after their second dose of MCV (median proportion, 97%; interquartile range, 87–100%) (1). A second dose should ideally be provided in the second year of life but at least one month after the first dose. For RCV, the effectiveness of one dose is  $\leq 95\%$  even at age 9 months.

Two doses of measles vaccine are needed for all susceptible people to achieve sufficiently high levels of population immunity to interrupt transmission (3). Because of the high immunogenicity of RCV, high population immunity to rubella could be achieved with high coverage of a single dose of RCV over successive birth cohorts. However, it is recom-

mended to administer RCV in combination with measles vaccine as MRCV or MMRV vaccine, following the two-dose MCV schedule for simplicity (2).

In addition to immunization programmes targeting children, special immunization activities targeting susceptible adolescents and young adults are needed in order to prevent outbreaks of measles and rubella among older age cohorts and to prevent cases of CRS following rubella infection of pregnant women. Emphasis should be placed on vaccinating susceptible hospital personnel, both male and female (for example, volunteers, trainees, nurses, physicians). Ideally, all hospital employees should be immune to measles and rubella. Other efforts should include vaccinations in family planning clinics, sexually transmitted infection (STI) clinics and as part of routine gynaecologic care; maximizing use of premarital serology results; emphasizing immunization for college students; vaccinating women postpartum and post abortion; immunizing prison staff and, when possible, prison inmates, especially women inmates; offering vaccination to at-risk women through the special supplemental programme for women, infants and children; and implementing vaccination programmes in the workplace (1).

During outbreaks of measles, MRCVs may be administered to infants as young as 6 months. Because of the possibility of lower seroconversion, the dose administered at 6 months should not be counted as a valid dose, and the child should be vaccinated with subsequent dose(s) of MRCVs according to the usual national immunization schedule (2).

Primary vaccine failures with live vaccine have stemmed from improper handling. Loss of potency of live vaccines can result from poor shipping or storage practices (2). Secondary vaccine failure rates are estimated to be about 5% at 10–15 years after immunization, but are probably lower when vaccination is given after 12 months of age (3).

Contraindications for MMR vaccine and MMRV vaccine are described to include a history of anaphylactic reactions to neomycin, a history of severe allergic reaction such as anaphylaxis or type 1 hypersensitivity to any component of the vaccine and immunosuppression (1). Other conditions such as prematurity, low birth weight or birth defects are not contraindications to MCV or RCV, and should not prevent otherwise eligible children from receiving appropriate vaccination.

Because of the theoretical, but never demonstrated, teratogenic risk, rubella vaccination of pregnant women should be avoided in principle (1). However, no cases of CRS have been reported in more than 3000 susceptible women who were unknowingly in the early stages of pregnancy when vaccinated against rubella (4). Women who intend to become pregnant should be advised to delay attempting pregnancy for one month following rubella vaccination. Although women should be asked about the possibility of early pregnancy prior to rubella vaccination, screening tests to exclude pregnant women are not required. Rubella vaccination of unknowingly pregnant women is not an indication for abortion (2).

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## 2. Public health intervention options for measles and rubella

### 2.1 DEFINITION OF MEASLES ELIMINATION AND RUBELLA ELIMINATION

Endemic transmission, elimination and re-establishment of endemic transmission are defined as follows (1):

1. **Endemic measles or rubella transmission:** the existence of continuous transmission of indigenous or imported measles or rubella viruses that persist for  $\geq 12$  months in any defined geographical area;
2. **Measles or rubella elimination:** the absence of endemic measles or rubella virus transmission in a defined geographical area (for example, a region) for  $\geq 12$  months in the presence of a well-performing surveillance system; and
3. **Re-establishment of endemic transmission:** occurs when epidemiological and laboratory evidence indicates the presence of a chain of transmission of a virus strain that continues uninterrupted for  $\geq 12$  months in a defined geographical area where measles had previously been eliminated.

### 2.2 CRITERIA FOR VERIFICATION OF MEASLES ELIMINATION AND RUBELLA ELIMINATION

Achievement and maintenance of measles and rubella elimination is verified once the following three essential criteria are met (1):

1. documentation of the interruption of the endemic measles and rubella viral transmission for a period of at least 36 months from the last known endemic case;
2. the presence of verification standard surveillance;<sup>2</sup> and

2. Verification standard surveillance includes the following: 1) reporting rate of non-measles, non-rubella cases at the national level of more than 2 cases per 100 000 population per year; 2)  $>80\%$  of second administrative level reporting at least 2 non-measles non-rubella cases per 100 000 population per year; 3)  $>80\%$  of suspected cases with adequate investigation initiated within 48 hours of notification; and 4)  $>80\%$  of suspected cases with adequate specimen for detecting acute measles or rubella infection collected and tested in a proficient laboratory. For countries without systems in place to collect the data required to calculate the above indicators, additional evidence may be submitted to demonstrate measles surveillance sensitivity and quality.

3. genotyping evidence that supports the interruption of endemic measles virus transmission.

Achievement and maintenance of measles and rubella elimination can be attained and sustained though achieving and maintaining >95% population immunity to measles and rubella in each birth cohort within each district of each country (2, 3). In an effort to achieve and maintain >95% population immunity to measles and rubella in each birth cohort within each district of each country, the national immunization programme is expected to be further enhanced and strengthened not only at the national level as a whole but also in every province and district (2, 4).

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## 2.3 CONTROL VERSUS ELIMINATION

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### *Control*

Moderate-to-high immunization coverage may significantly reduce and eventually interrupt measles or rubella viral transmission for periods of time, resulting in few cases for some years (“control”). However, eventually the number of susceptible people grows until there are enough non-immune individuals to sustain an epidemic. With moderate-to-high immunization coverage that is not high enough to achieve and maintain >95% population immunity to measles and rubella in each birth cohort within each district of each country, there will eventually be a large measles or rubella epidemic through the accumulation of susceptibles. Such epidemics are likely to have a disproportionate impact because: (i) health services are no longer used for dealing with measles and rubella and there will be many cases; and (ii) a greater proportion of cases will be in older children and young adults (4).

### *Elimination*

If immunization coverage is high enough to achieve and maintain >95% population immunity to measles and rubella in each birth cohort within each district, then not enough susceptibles will accumulate to cause an epidemic and each importation will only lead to a few secondary cases (4). Considering the contagiousness and severe complications of measles, disease burden and severity of rubella infection in pregnant women and CRS, it is clear that elimination is the only appropriate public health intervention option against measles and rubella disease.

Equity is another argument for elimination. Children who are most at risk of disease (the poor and other disadvantaged groups) tend to be insufficiently served by health services.

An elimination goal necessarily means that all at-risk children, groups and communities should be reached. If the lessons learnt in reaching underserved populations for immunization can be used for other basic health services, long-term benefit will accrue. In addition, infants too young to be vaccinated and those who have contraindications (for example, immunosuppressed) can be protected by elimination, but not by control. Elimination is a “public good” that benefits the population as a whole, especially the most at-risk members of the community (4).

Investments towards the goals of achieving and maintaining elimination of measles and rubella should be leveraged as a platform to broadly strengthen immunization programmes and overall health systems and to deliver other key health interventions such as vitamin A supplementation, growth monitoring and deworming. Application of this so-called “diagonal approach” that includes strengthening the overall immunization programme and health systems is critical for both achievement and maintenance of measles and rubella elimination. In addition, progress towards measles and rubella elimination can serve as a useful overall programme quality indicator to guide public health interventions. Due to the high infectiousness of measles and the high severity of CRS, outbreaks of these diseases are highly visible, result in public demand for interventions and signal areas of public health weakness to be strengthened, including routine and supplementary immunization activities (SIAs) and disease surveillance, and highlight special populations likely to be missed by other public health activities.

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## 2.4 FEASIBILITY OF ELIMINATION

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### *Countries in the Americas*

In 1994, having successfully eliminated polio, all countries of the WHO Region of the Americas agreed to the goal of measles elimination by the year 2000 through Resolution CSP24.R16 of the Pan American Sanitary Conference (the equivalent of a WHO Regional Committee resolution). The strategy of the Pan American Health Organization (PAHO), which also serves as the WHO Regional Office for the Americas, was to “catch up” through a wide-age-range campaign targeting children 9 months to 14 years old, “keep up” by increasing routine measles immunization coverage, “follow up” with periodic subsequent national SIAs usually targeting children 9–59 months among whom large numbers of susceptible children may have accumulated, and “mop up” through a house-to-house immunization approach among groups and areas at risk for being missed during routine and supplementary immunization activities. As a result of successful implementation of these strategies, measles elimination had been achieved in almost all countries of the

Region by 2000, but outbreaks in the Dominican Republic and Haiti (2000), Venezuela (2001) and Colombia (2002) delayed achievement of regional elimination until 2002.<sup>3</sup>

In 2003, PAHO's Directing Council adopted a resolution calling for rubella and CRS elimination in the Americas by the year 2010 based on the availability of a safe, affordable and effective vaccine, lessons learnt from vaccinating large and heterogeneous population groups with measles vaccine and MRCV, and evidence of the cost–benefit and cost–effectiveness of rubella elimination (5). Except for the Caribbean, Brazil, Costa Rica and Honduras, very wide-age-range MRCV SIAs targeting people up to 29 or 39 years old did not occur until 2004 and later, after the endorsement of a 2010 rubella elimination goal and two years after the last endemic measles case was identified in the Region of the Americas (6).

In 2015, the Region of the Americas was declared free of rubella and CRS, followed by measles-free status in 2016. The *Plan of Action for Maintaining Measles, Rubella and Congenital Rubella Syndrome Elimination* recommended preparation of a standardized regional framework to monitor progress towards permanent sustainability of elimination; strengthening routine immunization in order to maintain uniform vaccination coverage of 95% or higher with two doses of MMR vaccine in 80% of municipalities of each country; ensuring 95% coverage of vaccination campaigns; and preparing for rapid response to imported cases, including maintaining high-quality surveillance, in order to prevent re-emergence of endemic transmission from imported cases (7).

### *Countries and areas in the Western Pacific Region*

Through systematically and successfully conducting WHO-recommended strategies and guidelines (see sections 4.1 and 4.2), Australia, Macao SAR (China), Mongolia and the Republic of Korea in March 2014, Brunei Darussalam, Cambodia and Japan in March 2015, and Hong Kong SAR (China) in September 2016 were verified to have interrupted endemic measles virus transmission for more than 36 months.

Despite repeated multiple importations of measles virus from endemic countries, Australia, Brunei Darussalam, Cambodia, Hong Kong SAR (China), Japan, Macao SAR (China) and the Republic of Korea have prevented re-establishment of endemic measles virus transmission due to importations of the virus and successfully sustained measles elimination as of 2016.

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3. The Region of the Americas remained free of endemic measles until 2014, when an importation into Brazil of a D8 measles virus in 2013 and subsequent import-related transmission resulted in re-established transmission for more than one year.

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## 3. Rationale for measles and rubella elimination in the Western Pacific Region

### 3.1 MEASLES ELIMINATION IN THE WESTERN PACIFIC REGION

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In 1974, the year in which the Expanded Programme on Immunization (EPI) was launched, and before most countries and areas in the Region had introduced measles vaccine into routine vaccination schedules, 3 381 826 measles cases were reported to the WHO Regional Office for the Western Pacific. Assuming an average case fatality rate of 1%, 33 818 children died that year from measles. As countries introduced measles vaccine into their routine vaccination schedules and expanded their immunization programmes nationwide, the number of measles cases and associated deaths declined substantially. By 1990, regional measles vaccination coverage reached 93%, the number of reported cases decreased to 155 000, and the annual number of measles deaths dropped to 1 561.

However, the data reported through the WHO/UNICEF Joint Reporting Form (JRF) vastly underestimates the number of measles cases, which is the result of weak surveillance systems, especially in countries and areas with the highest disease burdens. WHO estimated that in 2002, the measles burden in the Western Pacific Region might have been as high as 6.7 million cases, with nearly 30 000 deaths (1). Measles remained a leading cause of disease, disability and death among children in the Region (2).

In addition, while the poliomyelitis-free status of the Region was certified in 2000, the full potential gains from immunization have not yet been obtained. For example, of the more than 25.3 million children estimated to have been born in the Region in 2002, more than 5 million did not receive the recommended three doses of diphtheria-tetanus-pertussis vaccine and 4.9 million did not receive measles vaccine (2).

In 2003, the WHO Regional Committee for the Western Pacific decided that measles elimination and hepatitis B control should be the two new pillars to strengthen EPI and urged Member States to offer, in principle, all children two doses of measles vaccine – taking into account local situations – so that the 95% population immunity of each birth cohort can be achieved and maintained in every district (3).

In 2005, the WHO Regional Committee decided that the Region should aim by 2012 to eliminate measles and urged Member States to develop or strengthen national plans for measles elimination.

In 2012, the Regional Committee reaffirmed its commitment to eliminate measles in the Western Pacific Region and urged Member States to interrupt all residual endemic measles virus transmission as rapidly as possible, through ensuring high population immunity with measles vaccine, and to establish national verification committees that develop regular progress reports for submission to the Regional Verification Commission (4).

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### 3.2 RUBELLA ELIMINATION IN THE WESTERN PACIFIC REGION

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Rubella has been endemic and congenital rubella infection most likely has affected thousands of newborns annually in the Western Pacific Region (see section 1.2). The true magnitude of rubella and CRS, however, has not been adequately documented in the Western Pacific Region. Rubella is usually undetected because it is a mild disease: fever is frequently low grade; rash is undetected in as many as 50% of rubella cases; and complications are few and infrequent. CRS is usually undetected because: (i) pregnant women who deliver babies with congenital birth defects are unlikely to remember having contracted a mild fever and rash illness during early pregnancy; and (ii) birth defects such as hearing impairment and congenital heart disease often remain unnoticed during much, if not all, of the child's infancy.

Nonetheless, the Regional Committee continued to urge Member States to accelerate control of rubella and the prevention of CRS in 2010 (5) and to further accelerate control of rubella and prevention of congenital CRS through integration of measles and rubella immunization and surveillance activities in 2012 (4).

The herd immunity threshold for rubella has been estimated at between 85% and 91%, which is lower than that estimated for measles (94%). Rubella vaccination coverage through routine immunization programmes is almost identical to that of measles because all countries in the Western Pacific Region provide RCV combined with measles vaccine; measles- and mumps-containing vaccine; or measles-, mumps- and varicella-containing vaccine. In addition, surveillance for rubella can be seamlessly integrated with measles case-based surveillance by broadening the case definition to capture patients with maculopapular rash and fever. With progress made in measles elimination in the Western Pacific Region, rubella elimination might be easier to achieve than measles elimination.

In 2014, the Regional Committee endorsed the *Regional Framework for Implementation of the Global Vaccine Action Plan in the Western Pacific* and its specified immunization goals, which include regional rubella elimination (6).

## References

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1. WHO Regional Committee for the Western Pacific Working Document, RC56/11.
2. WHO Regional Committee for the Western Pacific Working Document, RC54/5.
3. WHO Regional Committee for the Western Pacific Resolution, WPR/RC54.R3 (Appendix 1).
4. WHO Regional Committee for the Western Pacific Resolution, WPR/RC63.R5 (Appendix 2).
5. WHO Regional Committee for the Western Pacific Resolution, WPR/RC61.R7.
6. WHO Regional Committee for the Western Pacific Resolution, WPR/RC65.R5 (Appendix 3).



## SITUATION

All countries and areas in the Western Pacific Region have actively conducted the strategies and activities for measles elimination defined by the *Western Pacific Regional Plan of Action for Measles Elimination*, endorsed in 2003 by the WHO Regional Committee for the Western Pacific and detailed in the *Field Guidelines for Measles Elimination*, published in 2004 by the WHO Regional Office for the Western Pacific.

As a result, countries and areas in the Region strengthened their national immunization programmes and significantly reduced measles transmission, morbidity and mortality by end of 2012, in an effort to reach the regional measles elimination goal. Despite this achievement, the Western Pacific experienced a Region-wide measles resurgence from 2013 to 2016.

This section summarizes the strategies and activities for measles elimination recommended by the *Western Pacific Regional Plan of Action for Measles Elimination* and specified by the *Field Guidelines for Measles Elimination* (Chapter 4), reviews implementation of these strategies and activities, and highlights progress and achievements attained by the implementation of the strategies and activities (Chapter 5), analyses causes for the Region-wide measles resurgence from 2013 to 2016 (Chapter 6), and specifies unresolved issues and emerging challenges to be urgently addressed to achieve and sustain measles (and rubella) elimination in all countries and areas of the Western Pacific Region (Chapter 7).

## 4. Strategies carried out for measles and rubella elimination in the Western Pacific Region, 2003–2015

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### 4.1 Western Pacific Regional Plan of Action for Measles Elimination (2003)

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*Western Pacific Regional Plan of Action for Measles Elimination*, endorsed by the WHO Regional Committee for the Western Pacific in 2003 in resolution WPR/RC54.R3, recommended three strategies for measles elimination:

1. achieve and maintain 95% population immunity to measles in each birth cohort within each district of each country in the Region through: (i) achieving effective and timely routine delivery of measles vaccine to each new birth cohort; (ii) achieving effective second-opportunity measles vaccine delivery; and (iii) routinely monitoring population immunity;
2. develop and maintain effective surveillance in each country in the Region through building case-based surveillance, including response to cases, with laboratory confirmation; and
3. develop and maintain effective access to an accredited laboratory for each country in the Region through providing laboratory support for measles diagnosis and virus tracking.

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### 4.2 Field Guidelines for Measles Elimination (2004)

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*Field Guidelines for Measles Elimination*, published in 2004 by the WHO Regional Office for the Western Pacific, provides guidance for countries to implement the *Western Pacific Regional Plan of Action for Measles Elimination*. The Guidelines encourage countries:

1. to develop or strengthen their national plans for measles elimination;
2. to establish a national measles elimination coordinating committee to provide the strategic and technical guidance to the national immunization programme in developing the national plan, as well as assistance in its implementation;

3. to achieve 95% immunity in each cohort of children born after the adoption of the elimination goal through: (i) protecting every newborn child through routine immunization; and (ii) periodic SIAs for children as long as routine immunization coverage is less than 95% even for routine programmes that include two doses of MCV;
4. to conduct school-entry checks of immunization status to ensure that every child who starts school has received the recommended two doses of MCV;
5. to define groups likely to have less than 95% population immunity by age, geographic location and other characteristics such as ethnicity or religious affiliation;
6. to conduct SIAs for identified groups with less than 95% immunity to prevent future outbreaks;
7. to develop and implement special immunization strategies in high-risk areas, such as areas with crowded populations, with a large number of “unregistered” or migrant children, with ethnic populations, and those that are physically remote;
8. to establish and improve case-based measles surveillance to collect a minimum data set at the national level on each case, including but not limited to information on age, gender, vaccination status, place of residence, travel history, date of rash onset and disease outcome;
9. to establish and strengthen laboratory support for confirmation of the clinical diagnosis via identification of measles-specific IgM-antibodies and/or identification of measles virus in appropriate clinical specimens;
10. to eliminate rubella at the same time as measles by using measles-rubella (MR) vaccine or measles, mumps and rubella (MMR) vaccine; and
11. to utilize measles elimination as an opportunity for other health interventions, for example, vitamin A supplementation, anti-helminthic treatment [deworming], delivery of bed nets (malaria prevention), and other vaccines as possible interventions to be incorporated in the routine programme or regular SIAs.

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### 4.3 Rubella Vaccines: WHO Position Paper (2011)

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*Rubella Vaccines: WHO Position Paper*, published in 2011, provides guidance on the introduction and use of RCVs in national immunization schedules, and suggests the following vaccination strategies for rubella and CRS elimination within 10 years:

1. immunization of children, adolescents and adults through speed-up campaigns;

2. maintenance of RCV immunization coverage of 80% or greater, through routine immunization with one dose, and regular follow-up campaigns targeting all children born since the previous campaign (typically conducted nationwide every two to four years, targeting children aged 9–59 months), or two doses given through routine immunization after a speed-up campaign;
3. integration of rubella surveillance with the measles surveillance system, including investigation of all febrile rashes in pregnant women;
4. routine surveillance for CRS, or active CRS surveillance during rubella outbreaks, if routine CRS surveillance not implemented, according to WHO standards for CRS surveillance;<sup>4</sup>
5. vaccination of health workers to prevent outbreaks within health institutions; and
6. measuring coverage of vaccination by age and locality, including adult age groups, to enable monitoring of the programme's impact over time and guide future programme activities.

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#### 4.4 Measles Elimination Field Guide (2013)

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*Measles Elimination Field Guide*, published in 2013 by the WHO Regional Office for the Western Pacific, provides updated guidance for countries to build on the progress towards measles elimination in the Western Pacific. The Guide encourages countries:

1. to achieve and maintain 95% vaccination coverage with two doses of MCV through routine immunization, adding SIAs when required;
2. conduct high-quality, case-based measles surveillance, including active surveillance of suspected measles cases, supported by complete and timely investigation and specimen collection;
3. ensure high-quality laboratory performance through accredited laboratories that are able to conduct timely and accurate testing of samples to confirm or discard suspected measles cases and detect measles virus for genotyping and molecular analysis; and
4. develop and maintain outbreak preparedness, rapidly responding to measles outbreaks, and manage measles cases.

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4. WHO-recommended standards for surveillance of selected vaccine-preventable diseases, May 2003.

## 5. Implementation of strategies 2003–2015, progress and achievements

### 5.1 Immunization

#### *Second dose of measles-containing vaccine (MCV2) introduced across the Region*

In 2003, when the Regional Measles Elimination Initiative was inaugurated, only 23 out of 37 countries and areas in the Region had introduced a second dose of measles-containing vaccine (MCV2) into their national immunization programmes. Japan, Viet Nam, the Philippines, Cambodia, Papua New Guinea and the Lao People's Democratic Republic introduced MCV2 into the national immunization programmes in 2006, 2006, 2010, 2011, 2015 and 2017, respectively. As of 2017, only two countries of 37 countries and areas in the Region have not yet introduced routine MCV2. Solomon Islands has developed a plan for introduction of MCV2 in 2018, and Vanuatu has not finalized plans for the introduction of MCV2.

#### *Routine immunization programme strengthened and routine vaccination coverage improved*

Routine immunization programmes have improved remarkably in many countries in the Region since 2003, when the Regional Measles Elimination Initiative was launched. Coverage with a first dose of measles-containing vaccine (MCV1) has significantly increased in Cambodia, the Lao People's Democratic Republic, New Zealand and Papua New Guinea. China, Hong Kong SAR (China), Mongolia and the Republic of Korea maintained > 95% reported vaccination coverage with both MCV1 and MCV2 in 2010–2015. Viet Nam has maintained > 95% vaccination coverage with MCV1 since 2010, and MCV2 coverage increased from 83.2% in 2012 to 94% in 2014. When considering countries other than the Pacific island countries and areas, almost all countries, with the exception of the Lao People's Democratic Republic, Papua New Guinea and the Philippines, achieved > 90% reported vaccination coverage with both MCV1 and MCV2 since 2010 (Table 2). As an epidemiologic block for measles elimination, Pacific island countries and areas have high vaccination coverage. However, programmes need strengthening in Kiribati, the Marshall Islands, the Federated States of Micronesia, Samoa, Solomon Islands and Vanuatu. Vaccination coverage data are not available from American Samoa.

**Table 2.** Reported MCV coverage by country in the Western Pacific Region, 2010–2016

Country/ Area	MCV1							MCV2						
	2010	2011	2012	2013	2014	2015	2016	2010	2011	2012	2013	2014	2015	2016
AUS	94	94	94	94	94*	95*	ND	88	90	91	92	93*	93	94
BRN	94	91	99	96	97	96	98	93	93	96	92	96	98	97
KHM	93	93	93	90	94	73	123	ND	ND	82	64	95	72	105
CHN	99	100	100	100	99	99	100	99	100	100	100	100	99	99
– HOK	95	95	95	95	95	95	95	95	95	95	95	95	95	95
– MAC	ND	93	93	99	93	91	94	ND	90	89	96	93	91	92
JPN	94	94	96	95	98	94	96	97	92	92	93	96	93	93
LAO	64	69	72	82	87	88	76	ND	ND	ND	ND	88	ND	ND
MYS	95	95	86	97	94	99	ND	95	ND	99	99	93	99	99
MNG	97	98	99	97	98	98	99	95	98	98	97	98	98	90
NZL	95*	95*	95*	95*	95*	86	92	90*	91*	NA*	NA*	NA*	87	89
PNG	59	60	67	70	65	60	51	ND	ND	ND	ND	60	ND	ND
PHL	80	79	85	90	88	59	80	10	28	38	53	77	63	66
KOR	98	99	99	100	100	96	98	98	98	97	95	98	97	97
SGP	95	95	95	95	95	88	ND	94	94	95	ND	95	90	ND
VNM	98	97	96	98	97	94	99	98	93	83	86	97	92	95
PICs	75	79	84	87	87	95	86	74	78	84	91	85	90	ND

≥ 95% coverage
  90–94% coverage
  85–89% coverage
  < 85% coverage

**AUS:** Australia; **BRN:** Brunei Darussalam; **KHM:** Cambodia; **CHN:** China; **HOK:** Hong Kong SAR (China); **MAC:** Macao SAR (China); **JPN:** Japan; **LAO:** Lao People’s Democratic Republic; **MYS:** Malaysia; **MNG:** Mongolia; **NZL:** New Zealand; **PNG:** Papua New Guinea; **PHL:** Philippines; **KOR:** Republic of Korea; **SGP:** Singapore; **VNM:** Viet Nam; **PICs:** Pacific island countries and areas

\* Data updated by government in May 2017 – NA: not available; ND: no data

Source: WHO/UNICEF Joint Reporting Forms (JRF).

### Supplementary immunization activities (SIAs) conducted

From 2000 to 2015, 445 million children in the Western Pacific Region were reached by national immunization programmes through mass vaccination campaigns with MCV SIAs or MRCV SIAs (Table 3).

Reported vaccination coverage of nationwide SIAs reached >95% in Cambodia (2011 and 2013), China (2010), the Lao People’s Democratic Republic (2011 and 2014) and Viet Nam (2010); 93% in the Philippines (2014); and 91% in Mongolia (2012). In the Pacific, reported vaccination coverage of nationwide SIAs was 102% in 2012 (rapid coverage assessment,

or RCA, 95%) and 93% in 2014 in Solomon Islands; 91% (RCA, 94%) (subnational) in 2010, 95.8% (subnational) in 2011, 96% (subnational) in 2013 and 86.6% in 2014 in the Federated States of Micronesia; and 102% (RCA 92%) in 2013 and 103% in 2015 in Vanuatu.

From 2008 to 2016, 7 out of 16 non-Pacific island countries carried out nine nationwide RCV SIAs using MRCV: Japan in 2008–2012 targeting birth cohorts born in 1990–1999; the Lao People’s Democratic Republic in 2011 targeting birth cohorts born in 1992–2010 (MRCV) and in 2014 targeting birth cohorts born in 2004–2013; the Philippines in 2011 targeting birth cohorts born in 2002–2010, and in 2014 targeting birth cohorts born in 2009–2013; Mongolia in 2012 targeting birth cohorts born in 1998–2009; Cambodia in 2013 targeting birth cohorts born in 1999–2012; Viet Nam in 2014–2015 targeting birth cohorts born in 2000–2013; and Papua New Guinea in 2015–2016 targeting birth cohorts born in 2000–2014.

Several countries (for example, the Lao People’s Democratic Republic, the Philippines, Papua New Guinea and Solomon Islands) actively conducted MCV SIAs with other child health interventions, for example, OPV SIAs, vitamin A supplementation and/or anti-helminthic treatment (deworming).

### *Measles- and rubella-containing vaccine introduced across the Region*

According to JRF reports, the number of countries using RCV in their routine schedule increased from 11 (31%) in 1996 to 37 (100%) in 2016. A total of 23 countries and areas (62%) have also protected women up to 15–20 years of age with RCV.

### *Collaboration with education sector enhanced*

Collaboration with education sector for immunization has been significantly enhanced through efforts made to strengthen routine immunization programme (for example, China, Malaysia and the Republic of Korea) and to conduct SIAs (for example, Cambodia and Japan) for measles elimination.

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## 5.2 Surveillance

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### *Measles and rubella case-based surveillance established in all countries and areas*

Case-based measles and rubella surveillance has been established in all countries and areas in the Western Pacific Region. In 2008, regionally standardized performance

indicators for measles surveillance were developed and then made consistent with globally recommended indicators for verifying the elimination of measles and rubella.<sup>5</sup>

In 2015, 35 of 37 countries and areas in the Region monthly shared with WHO datasets of every suspected measles or acute fever and rash (AFR) case, including case information on age, gender, vaccination status, place of residence, travel history, date of rash onset and disease outcome. Information and data collected by the Case-based Measles and Rubella Surveillance have enabled countries and WHO to describe and analyse details on measles and rubella epidemiology and further elaborate strategies for measles and rubella elimination in the Western Pacific Region.

Based on the dataset of Case-based Measles and Rubella Surveillance monthly reports shared by countries, together with information and data from other sources, such as the JRF, the WHO Regional Office for the Western Pacific develops and distributes the monthly *Measles-Rubella Bulletin* ([http://www.wpro.who.int/immunization/documents/measles\\_rubella\\_bulletin/en](http://www.wpro.who.int/immunization/documents/measles_rubella_bulletin/en)) and *Regional and Country Profiles of Measles Elimination* ([http://www.wpro.who.int/immunization/documents/measles\\_regional\\_country\\_profile/en](http://www.wpro.who.int/immunization/documents/measles_regional_country_profile/en)) periodically to countries and partners.

### *Measles and rubella case-based surveillance continuously improved in all countries and areas*

Continued improvement has been seen recently in both the reporting rate of discarded measles cases at the national level per 100 000 population and the proportion of the second administrative level units reporting at least two discarded measles cases. Particularly, the reporting rate of discarded measles cases at the national level per 100 000 population has gone beyond the target in all priority countries in the Region in 2014. Both the proportion of suspected measles cases with adequate investigation and the proportion of suspected measles cases with adequate blood specimens continued to improve recently in many countries, while the proportion of suspected measles cases with adequate investigation in several priority countries should improve further (Table 4).

The Regional Verification Commission (RVC) for Measles Elimination in the Western Pacific confirmed in March 2015 that Australia, Brunei Darussalam, Cambodia, Japan, Macao SAR (China), Mongolia and the Republic of Korea had achieved and sustained verification-standard epidemiological surveillance systems supported by WHO-accredited laboratories. Furthermore, in September 2016, Hong Kong SAR (China) had also achieved and sustained verification-standard epidemiological surveillance system supported by WHO-accredited laboratories.

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5. World Health Organization. Framework for verifying elimination of measles and rubella. *Wkly Epidemiol Rec.* 2013;88(9):89-99.

**Table 3.** Reported MCV coverage by country/area in the Western Pacific Region, 2010–2016

	2000s				
	Year	Vaccine	Age	No. vaccinated	Coverage
<b>COUNTRIES</b>					
<b>AUSTRALIA</b>					
<b>BRUNEI DARUSSALAM</b>	2008–2009	MMR	1–6 years	27 161	98%
	2007	M	9–59 months	1 526 530	104%
<b>CAMBODIA</b>					
<b>CHINA</b>	2003–2009	M	8 months–14 years	195 764 099	95%
– HONG KONG SAR					
– MACAO SAR					
<b>JAPAN</b>	2008–2012	MR**	13 and 18 years		
<b>LAO PEOPLE'S DEMOCRATIC REPUBLIC</b>	2000–2001	M	9–59 months	603 838	86%
	2007	M	9 months–14 years	2 086 190	96%
<b>MALAYSIA</b>					
	2000	M	9 months–7 years	291 000	97%
<b>MONGOLIA</b>	2001	M	6 months–30 years	259 590	95%
<b>NEW ZEALAND</b>					
	2003–2005	M	6 months–10 years	2 315 477	97%
<b>PAPUA NEW GUINEA</b>	2009	M	6 months–6 years	945 582	86%
<b>PHILIPPINES</b>					
	2001	MR	8–16 years	5 614 327	96%
<b>REPUBLIC OF KOREA</b>	2004–2005	M**	8 years	1 273 318	99%
	2006–2009	MMR**	8 years	2 205 705	99%
<b>SINGAPORE</b>					
<b>VIET NAM</b>	2001–2003	M	9 months–10 years	15 614 941	99%
	2007–2008*	M	1–20 years	4 738 173	97%

\*: large subnational; \*\*: school-based, 1 or 2 cohorts to fill in programme gaps

2010s					
	Year	Vaccine	Age	No. vaccinated	Coverage
AUSTRALIA					
BRUNEI DARUSSALAM					
CAMBODIA	2011	M	9–59 months	1 504 216	100%
	2011*	M	5–9 years	318 129	103%
	2013	MR	9 months–14 years	4 576 633	105%
CHINA	2010	M	various	102 300 000	95%
– HONG KONG SAR					
– MACAO SAR					
JAPAN					
LAO PEOPLE'S DEMOCRATIC REPUBLIC	2011	MR	9 months–19 years	2 614 002	97%
	2014	MR	9 months–10 years	1 569 224	100%
MALAYSIA	2015	M/MMR	0–17 years	21 518	89%
MONGOLIA	2012	MR	3–14 years	522 429	93%
	2015	M	6 months–5 years	347 685	95%
NEW ZEALAND					
PAPUA NEW GUINEA	2010	M	6–35 months	233 775	42%
	2012	M	6–35 months	552 872	88%
	2015	MR	6 months–15 years	801 436	62%
PHILIPPINES	2011	MR	9 months–9 years	15 649 907	84%
	2013	M	6–59 months	2 046 254	20%
	2014	MR	9–59 months	10 402 489	91%
REPUBLIC OF KOREA					
SINGAPORE	2013	MMR**	6–7 years	38 436	95%
VIET NAM	2010	M	12–59 months	7 034 895	96%
	2014–2015	MR	1–14 years	19 735 753	98%

**Table 3.** Reported MCV coverage by country/area in the Western Pacific Region (continued)

	2000s				
	Year	Vaccine	Age	No. vaccinated	Coverage
<b>PACIFIC ISLAND COUNTRIES AND AREAS (PICs)</b>					
<b>AMERICAN SAMOA</b>					
<b>COOK ISLANDS</b>	2004	M	1–5 years		88%
	2006–2007	MR	1–35 years	6 124	90%
<b>FIJI</b>	2001		9 months–5 years		86%
	2006	MR	6 months–4 years	89 747	98%
<b>FRENCH POLYNESIA</b>					
<b>GUAM</b>					
<b>KIRIBATI</b>	2006	MR	1–14 years F: 15–19 years	40 568	95%
	2009	MMR	12–59 months	9 865	107%
<b>MARSHALL ISLANDS</b>	2002	MMR	12–48 months	4 683	77%
	2003	MMR	6 months–40 years	33 508	91%
<b>MICRONESIA (FEDERATED STATES OF)</b>	2004*	MMR	1–14 years	17 847	87%
<b>NAURU</b>	2003	M	9 months–19 years		
<b>NEW CALEDONIA</b>					
<b>NIUE</b>	2003	MMR	5–11 years	100	36%
<b>NORTHERN MARIANA ISLANDS</b>	2002	MMR	1–6 years	438	35%
<b>PALAU</b>					
<b>SAMOA</b>	2003	MR	1–18 years	47 448	88%
	2005	MR	9–35 months	11 610	86%
	2008	MR	9–59 months	22 864	91%
	2009	MR	6–59 months	21 142	76%
<b>SOLOMON ISLANDS</b>	2006	M	12–48 months	60 025	90%
	2009	M	12–48 months	60 025	90%
<b>TOKELAU</b>	2003	MMR		838	98%
<b>TONGA</b>	2002	MR			95%
<b>TUVALU</b>	2001		9 months–5 years		100%
	2005	MR	1–34 years	5 469	96%
<b>VANUATU</b>	2006	M	1–12 years	78 296	99%
	2009	M	12–59 months	29 919	98%
<b>WALLIS AND FUTUNA</b>					

\*: large subnational

	2010s				
	Year	Vaccine	Age	No. vaccinated	Coverage
AMERICAN SAMOA					
COOK ISLANDS					
FIJI	2011	MR	women & children	4 000	
FRENCH POLYNESIA					
GUAM					
KIRIBATI					
MARSHALL ISLANDS					
MICRONESIA (FEDERATED STATES OF)	2014	MMR	6 months–57 years	71 388	87%
NAURU					
NEW CALEDONIA					
NIUE					
NORTHERN MARIANA ISLANDS					
PALAU	2011	M	6 months–2 years		82%
SAMOA					
SOLOMON ISLANDS	2012	MR	12–59 months	67 106	101%
	2014	MR	6 months–30 years	398 622	106%
TOKELAU					
TONGA					
TUVALU	2010	M	1–5 years	1 095	78%
VANUATU	2013	MR	12–59 months	33 604	102%
	2015	MR	1–15 years	103 676	100%
WALLIS AND FUTUNA					

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### 5.3 Regional Measles and Rubella Laboratory Network established

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#### *Regional Measles and Rubella Laboratory Network established*

The WHO Measles and Rubella Laboratory Network in the Western Pacific Region (M&R LabNet) was established in 1998, following the model of the Polio Laboratory Network structure and utilizing many of the same laboratories supported by the Regional Polio Eradication Initiative in the Western Pacific.

The M&R LabNet performs critical functions in monitoring progress towards the regional measles and rubella elimination goal by confirming or discarding suspected measles and rubella cases with IgM detection. In 2016, the M&R LabNet consisted of one global specialized laboratory (GSL) in Japan, three regional reference laboratories (RRLs) in Australia, China and Hong Kong SAR (China), 16 national laboratories, including four laboratories in the Pacific (Fiji, French Polynesia, Guam and New Caledonia), 31 provincial laboratories and 331 prefecture laboratories in China, three subnational laboratories in Viet Nam, and one subnational laboratory in Malaysia. There are 386 laboratories in the M&R LabNet in the Region.

All national measles-rubella laboratories (NMRLs) in the Region are regularly updated on progress and issues in the regional measles and rubella elimination initiative, and they are provided with recommendations to strengthen molecular detection capacity and data reporting and to ensure quality performance of network laboratories. To ensure the quality of network laboratories, WHO also conducts an annual accreditation programme for 51 network laboratories, including 31 provincial laboratories in China. As part of the quality control and quality assurance programme, all NMRLs participate in an external quality control programme for proficiency testing (PT) of measles and rubella viral isolation, and NMRLs with advanced capacity participate in molecular proficiency testing. All laboratories participate in quality control by sending a percentage of samples for confirmatory testing at RRLs.

#### *Geographic distribution of measles and rubella viruses analysed and described by genotype*

While molecular techniques were available primarily at the RRL level before 2010, most NMRLs in the Region have developed the capacity to determine measles genotypes through the reverse transcription polymerase chain reaction (RT-PCR) method since 2010. As a result, these countries are able to describe the temporal and spatial distribution of measles and rubella virus genotypes across the Region and provide national immunization programmes and decision-makers with molecular epidemiologic data, including potential routes of virus transmission.

From 2013 to 2015, the predominant measles viral genotypes detected in the Region were H1, B3, D8 and D9.

The genotype H1 measles virus is endemic in China and was also frequently detected in Australia, Hong Kong SAR (China), Japan, Macao SAR (China), Malaysia, Mongolia, the Republic of Korea, Singapore and Viet Nam in 2013–2015. The genotype H1 measles virus caused large-scale measles outbreaks in the northern part of Viet Nam in 2013–2014 and Mongolia in 2015–2016.

The genotype B3 measles virus has been endemic in the Philippines since early 2013, where D9 had been endemic before 2013 and not detected since 2013. The genotype B3 measles virus was also frequently detected in Australia, China, Hong Kong SAR (China), Japan, New Zealand, the Republic of Korea and Singapore from 2013 to 2015. The genotype B3 measles virus caused large-scale measles outbreaks in the Federated States of Micronesia, Papua New Guinea and Solomon Islands in 2014.

The genotype D8 measles virus has been endemic in Malaysia and was also frequently detected in Australia, Hong Kong SAR (China), Japan, New Zealand, the Republic of Korea, Singapore and Viet Nam in 2013–2015. The genotype D8 measles virus caused large-scale measles outbreaks in the southern part of Viet Nam in 2013–2014.

The genotype D9 measles virus was frequently detected in Australia, China, Hong Kong SAR (China), Japan, Malaysia, New Zealand and Singapore in 2013–2015.

In 2013 and the first half of 2014, China and Malaysia reported to WHO the detection of genotypes 2B and 1E rubella virus. In the second half of 2014 and 2015, China, Hong Kong SAR (China) and New Zealand reported detection of the genotype 2B rubella virus.

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## 5.4 Measles incidence

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Measles cases and incidence continued to decline significantly or be maintained at very low levels in many countries in the Region towards 2012, which was the regional measles elimination target year in the Western Pacific. As a result, the Region marked its historically lowest number of measles cases and incidence rate in 2012 – 10 794 cases and 5.9 per million population – compared with 177 265 cases and 105.2 per million population in 2000 (Fig. 1 and Table 5).

**Table 4.** Performance of epidemiologic surveillance by country and area in the Western Pacific Region, 2010–2016

COUNTRY/ AREA	National reporting rate of discarded measles cases per 100 000 population							% second administrative level units reporting $\geq 2$ discarded measles cases per 100 000 population						
	Target: $\geq 2$							Target: $\geq 80\%$						
	2010	2011	2012	2013	2014	2015	2016	2010	2011	2012	2013	2014	2015	2016
AUS*	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI
BRN*	1.8	1.5	1.5	3.8	3.5	4.5	2.8	NA	NA	NA	NA	NA	NA	NA
KHM*	17.1	20.2	6.8	3.7	4.3	4.4	4.2	63%	71%	63%	46%	83%	92%	72%
CHN	1.4	1.8	2.34	3.74	4.3	4.5	3.2	52%	71%	71%	68%	71%	84%	77%
– HOK*	0.2	3.1	2.5	2.5	2.1	2.1	2.5	NA	NA	NA	NA	NA	NA	NA
– MAC*	5.2	2.7	3.9	2.9	2.7	1.8	1.8	NA	NA	NA	NA	NA	NA	NA
JPN*	0.0	0.3	0.1	0.7	0.5	0.2	0.7	0%	0%	0%	4%	0%	0%	4%
LAO	2.9	5.2	7.6	7.5	4.1	8.1	5.4	24%	53%	65%	59%	59%	88%	59%
MYS	3.6	11.6	20.2	22.6	14.3	12.9	15.0	50%	94%	94%	100%	94%	88%	94%
MNG*	5.6	6.5	22.0	7.4	4.7	52.5	46.4	27%	14%	32%	36%	32%	82%	95%
NZL**	na	20.5	4.6	2.0	12.0	4.5	15.5	na	95%	90%	45%	95%	80%	95%
PNG	0.4	0.6	0.6	1.4	27.6	1.4	0.6	5%	15%	10%	25%	75%	20%	10%
PHL	4.3	3.1	2.1	3.3	4.5	1.4	1.5	94%	88%	71%	65%	59%	29%	18%
KOR*	0.3	0.3	0.3	0.8	2.4	0.6	0.6	0%	0%	0%	6%	44%	0%	0%
SGP	DI	DI	DI	1.3	1.6	1.1	1.6	NA	NA	NA	NA	NA	NA	NA
VNM	3.3	16.0	0.9	1.2	4.9	2.0	1.2	42%	72%	13%	22%	41%	16%	22%
PICs	1.5	17.0	5.6	2.0	4.1	6.6	8.3	13%	17%	13%	17%	22%	17%	13%
Western Pacific Region	1.7	2.8	2.4	3.6	4.2	4.0	3.0	39%	52%	35%	41%	52%	40%	38%

meets or exceeds the indicator target

nearly meets the indicator target

not meeting the indicator target

AUS: Australia; BRN: Brunei Darussalam; KHM: Cambodia; CHN: China; HOK: Hong Kong SAR (China); MAC: Macao SAR (China); JPN: Japan; LAO: Lao People's Democratic Republic; MYS: Malaysia; MNG: Mongolia; NZL: New Zealand; PNG: Papua New Guinea; PHL: Philippines; KOR: Republic of Korea; SGP: Singapore; VNM: Viet Nam; PICs: Pacific island countries and areas

\* RVC confirmed that verification-standard surveillance had been established.

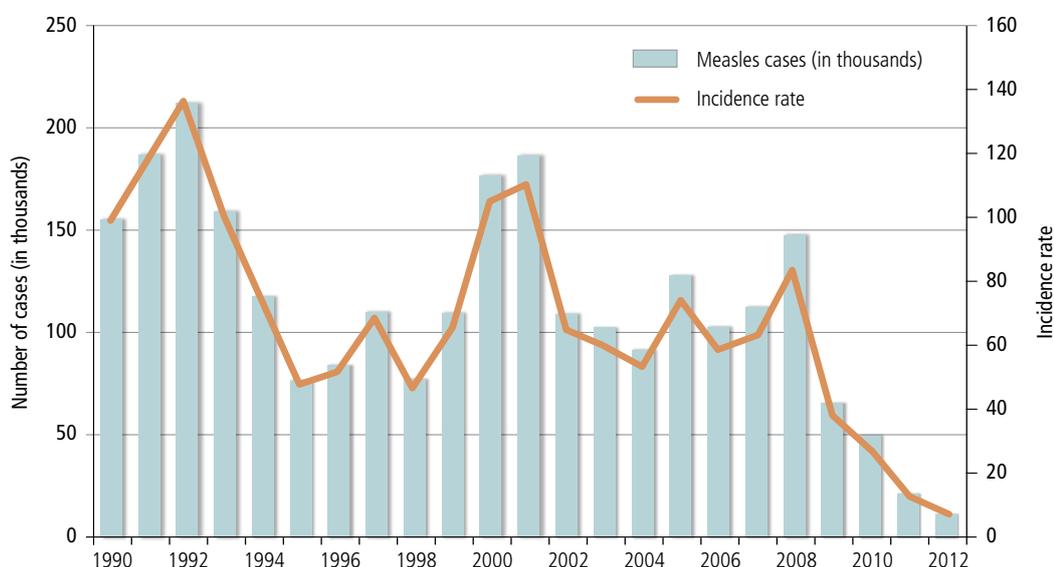
\*\* Data from national measles elimination progress report

DI: data are insufficient; na: not available; NA: not applicable

**Table 4.** Performance of epidemiologic surveillance (continued)

COUNTRY/ AREA	% suspected measles cases with adequate investigation							% suspected measles cases with adequate blood specimen						
	Target: ≥80%							Target: ≥80%						
	2010	2011	2012	2013	2014	2015	2016	2010	2011	2012	2013	2014	2015	2016
AUS	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI
BRN	86%	80%	100%	100%	100%	100%	100%	100%	90%	100%	100%	100%	96%	100%
KHM	48%	29%	56%	69%	69%	81%	88%	99%	92%	99%	98%	99%	99%	99%
CHN	89%	93%	98%	98%	91%	95%	97%	77%	90%	97%	97%	88%	86%	88%
– HOK	65%	98%	92%	94%	99%	99%	98%	88%	99%	97%	91%	93%	98%	99%
– MAC	71%	100%	96%	95%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
JPN	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI
LAO	33%	29%	49%	36%	75%	85%	99%	43%	54%	77%	67%	75%	86%	48%
MYS	39%	46%	73%	82%	73%	72%	80%	83%	85%	81%	81%	91%	83%	89%
MNG	58%	60%	64%	100%	100%	8%	8%	96%	100%	100%	100%	100%	14%	14%
NZL	DI	DI	DI	DI	DI	DI	DI	na	92%	85%	91%	96%	91%	92%
PNG	46%	40%	62%	0%	0%	61%	65%	100%	82%	81%	76%	63%	91%	90%
PHL	41%	89%	57%	46%	62%	57%	57%	87%	98%	80%	63%	84%	70%	70%
KOR	35%	64%	84%	64%	96%	69%	92%	78%	87%	90%	73%	63%	74%	80%
SGP	DI	DI	DI	75%	83%	92%	85%	DI	DI	DI	18%	25%	19%	14%
VNM	43%	20%	44%	49%	41%	33%	57%	71%	33%	55%	64%	76%	55%	78%
PICs	0%	0%	0%	0%	0%	0%	0%	4%	72%	20%	67%	12%	69%	82%
Western Pacific Region	74%	70%	88%	92%	23%	78%	71%	89%	78%	90%	90%	84%	74%	68%

Source: National measles and rubella monthly reports as of 20 February 2017.

**Figure 1.** Reported measles cases and incidence in the Western Pacific Region, 1990–2012

Source: WHO/UNICEF Joint Reporting Forms (JRF).

**Table 5.** Measles cases and incidence (per 1 million population) in selected countries and areas of the Western Pacific Region, 2008–2012

Country/Area	Year				
	2008	2009	2010	2011	2012
<b>AUSTRALIA</b>	65 (3.1)	104 (4.9)	70 (3.3)	192 (8.5)	199 (8.7)
<b>BRUNEI DARUSSALAM</b>	3 (7.5)	2 (5.0)	0 (0)	4 (9.9)	1 (2.4)
<b>CAMBODIA</b>	1 765 (120.1)	865 (58.4)	1 156 (76.8)	722 (50.5)	0 (0)
<b>CHINA</b>	131 441 (98.4)	52 461 (39.0)	38 159 (28.5)	9 943 (7.4)	6 183 (4.6)
– HONG KONG SAR (CHINA)	71 (9.8)	22 (3.1)	11 (1.6)	12 (1.7)	8 (1.1)
– MACAO SAR (CHINA)	6 (12.4)	0 (0)	0 (0)	1 (1.8)	1 (1.8)
<b>JAPAN</b>	10 939 (85.5)	705 (5.5)	432 (3.4)	411 (3.2)	228 (1.8)
<b>LAO PEOPLE'S DEMOCRATIC REPUBLIC</b>	113 (19.0)	72 (11.4)	153 (23.8)	113 (18)	36 (5.6)
<b>MONGOLIA</b>	31 (11.7)	8 (3.0)	7 (2.6)	0 (0)	0 (0)
<b>PAPUA NEW GUINEA</b>	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)
<b>REPUBLIC OF KOREA</b>	2 (0)	17 (0.4)	111 (2.3)	43 (0.9)	2 (0)
<b>VIET NAM</b>	259 (2.9)	5 221 (59.3)	1 826 (20.5)	745 (8.4)	637 (5.9)
<i>Pacific island countries/areas</i>	0 (0)	4 (4.7)	1 (0.3)	2 (1.0)	0 (0)
<b>Western Pacific Region</b>	145 934 (81.6)	61 291 (34.0)	48 490 (27.0)	21 088 (11.7)	10 794 (5.9)

Source: National measles and rubella monthly reports as of 3 May 2016.

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## 5.5 Verification of interruption of endemic measles virus transmission

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### *Regional Verification Commission and national verification committees established*

In 2010, the WHO Regional Committee for the Western Pacific requested the Regional Director to establish regional verification mechanisms for measles elimination and, in 2012, urged Member States to establish national verification committees (NVCs) to develop regular progress reports for submission. In April 2012, the Regional Verification Commission (RVC) for Measles Elimination in the Western Pacific was established to verify progress towards measles elimination and determine whether individual countries or areas, the Pacific subregion and the Region as a whole have eliminated endemic measles virus transmission. In March 2013, the *Guidelines on Verification of Measles Elimination in the Western Pacific Region* were finalized and distributed to NVCs in countries and areas of the Region providing definitions for measles elimination and other essential concepts, including three criteria and five lines of evidence required for documenting status towards measles elimination.

### *Interruption of endemic measles virus transmission verified to have been achieved in six countries and two areas in the Region*

In March 2014, the RVC verified Australia, Macao SAR (China), Mongolia and the Republic of Korea as having interrupted endemic measles virus transmission for more than 36 months. In March 2015, the RVC verified Brunei Darussalam, Cambodia and Japan as having interrupted endemic measles virus transmission for more than 36 months. In September 2016, the RVC verified Hong Kong SAR (China) as having done the same.

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## 5.6 Progress towards rubella elimination

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### *Platform for regional rubella elimination prepared along with the Regional Measles Elimination Initiative*

Nine out of 16 non-Pacific Asian countries and areas<sup>6</sup> introduced RCV into their national immunization programmes by 1990. Eight out of 21 Pacific island countries and areas<sup>7</sup>

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6. Australia (1989), Brunei Darussalam (1988), Hong Kong SAR (China) (1990\*), Macao SAR (China) (1989), Japan (1989), Malaysia (1982), New Zealand (1990), Republic of Korea (1983) and Singapore (1976) (year of introduction). \*Hong Kong SAR (China) included MMR in its routine immunization programme in 1990, but it started providing rubella vaccine to female primary school students (grade 6) in 1978.

7. American Samoa (1970s), French Polynesia (early 1990s), Guam (1980s), Marshall Islands (1982), Federated States of Micronesia (1982), New Caledonia (1994), Niue (late 1970s) and Palau (prior to 1995).

introduced RCV into their national immunization programmes before 1995. In 2002–2006, another eight Pacific island countries and areas<sup>8</sup> introduced RCV into their national immunization programmes, and Solomon Islands introduced RCV in 2013, bringing the total number of Pacific island countries and areas with RCV to 17. In 2007–2015, another seven non-Pacific countries introduced RCV into their national immunization programmes: China (2007), Mongolia (2009), the Philippines (2010), the Lao People’s Democratic Republic (2012), Cambodia (2013), Papua New Guinea (2015) and Viet Nam (2015). Consequently, all non-Pacific countries now have RCV in their immunization programme.

The WHO Regional Committee for the Western Pacific urged Member States in September 2003 in resolution WPR/RC54.R3 to use measles elimination strategies to strengthen EPI and other public health programmes, such as prevention of CRS. In October 2010 in resolution WPR/RC61.R7, the Regional Committee urged Member States to accelerate control of rubella and the prevention of CRS. Two years later, the Regional Committee in resolution WPR/RC63.R5 urged Member States to further accelerate control of rubella and prevention of CRS through integration of measles and rubella immunization and surveillance activities. Further action came in October 2014, when the WHO Regional Committee in resolution WPR/RC65.R5 endorsed the *Regional Framework for Implementation of the Global Vaccine Action Plan in the Western Pacific* and specified eight regional immunization goals for the Western Pacific, including rubella elimination.

### *Rubella elimination being achieved or targeted in several countries and areas*

As of 2017, all countries and areas in the Western Pacific Region have introduced RCV into the national immunization program.

As of 2017, New Zealand and the Republic of Korea have been verified as having eliminated rubella, and Australia and Singapore were approaching the elimination of rubella. Japan developed and officially issued a national plan and strategy for rubella elimination in 2014, with the intention of eliminating rubella by 2020.

Mongolia began development of a *National Strategy for Measles and Rubella Elimination 2016–2020*, intending to eliminate rubella by 2020. Cambodia is developing a national plan and strategy for rubella elimination, with a 2020 target date to eliminate rubella, the Lao People’s Democratic Republic and the Pacific Islands subregion plan to eliminate rubella by 2022. Viet Nam and the Lao People’s Democratic Republic plan to develop a national plan and strategy for rubella elimination by 2018.

8. Cook Islands (2006), Fiji (2003), Kiribati (2004), Nauru (2006), Samoa (2004), Tokelau (2003), Tonga (2002) and Tuvalu (2005).

## 6. Resurgence of measles in the Western Pacific Region in 2013–2016

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### 6.1 Regional measles resurgence in the Western Pacific in 2013–2016

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After achieving the historically lowest level of measles transmission and incidence for the Region in 2012, the Western Pacific was affected by a Region-wide measles resurgence in 2013–2016. The regional measles incidence rate (per 1 million population) increased from 5.9 in 2012 to 19.5 in 2013, 70.1 in 2014, 36.0 in 2015 and 30.1 in 2016 (Table 6). The regional measles resurgence was attributed to: (i) increased measles virus transmission in endemic countries; (ii) large-scale outbreaks following importation in countries with low transmission; (iii) multiple importations in countries with very low or interrupted endemic measles virus transmission; and (iv) re-establishment of measles virus transmission after elimination. Major determinants were inadequate population immunity and subpopulations with high susceptibility.

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### 6.2 Causes of the regional measles resurgence

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#### *Resurgence of measles virus transmission in endemic countries*

Measles virus is endemic in China (genotype H1 virus), the Philippines (genotype B3 virus) and Malaysia (genotype D8 virus) as of 2017.

In China, ongoing transmission of the genotype H1 measles virus significantly decreased before 2012 as a result of multiple province-wide measles SIAs between 2003 and 2009 and a nationwide measles SIA in 2010. This resulted in 2012 in the lowest measles incidence ever reported. However, the transmission increased following 2013.

In the Philippines, the measles genotype B3 virus became endemic in early 2013, while D9 was the predominant endemic genotype between 2010 and 2012. Following the nationwide MRCV SIA conducted in September 2014, measles virus transmission has continued, particularly in the middle and southern parts of the Philippines (Visayas and Mindanao).

In Malaysia, measles virus transmission has been ongoing but increased in 2011, 2012 and 2015. The genotype D8 measles virus was detected in 2013 and 2015.

**Table 6.** Measles cases and incidence (per 1 million population) in countries and areas of the Western Pacific Region, 2008–2015

Country/Area	Year							
	2008	2009	2010	2011	2012	2013	2014	2015
<b>AUSTRALIA</b>	65 (3.1)	104 (4.9)	70 (3.3)	792 (8.5)	199 (8.7)	154 (6.6)	340 (14.5)	74 (3.3)
<b>BRUNEI DARUSSALAM</b>	3 (7.5)	2 (5.0)	0 (0)	4 (9.9)	1 (2.4)	0 (0)	0 (0)	4 (9.0)
<b>CAMBODIA</b>	1 765 (120.1)	865 (58.4)	1 156 (76.8)	722 (50.5)	0 (0)	0 (0)	0 (0)	0 (0)
<b>CHINA</b>	131 441 (98.4)	52 461 (39.0)	38 159 (28.5)	9 943 (7.4)	6 183 (4.6)	27 825 (20.5)	52 485 (38.5)	42 864 (30.7)
– HONG KONG SAR	71 (9.8)	22 (3.1)	11 (1.6)	12 (1.7)	8 (1.1)	38 (5.2)	50 (6.8)	18 (2.4)
– MACAO SAR	6 (12.4)	0 (0)	0 (0)	1 (1.8)	1 (1.8)	3 (5.2)	1 (1.7)	0 (0)
<b>JAPAN</b>	10 939 (85.5)	705 (5.5)	432 (3.4)	411 (3.2)	228 (1.8)	207 (1.6)	454 (3.6)	35 (0.3)
<b>LAO PEOPLE'S DEMOCRATIC REPUBLIC</b>	113 (19.0)	72 (11.4)	153 (23.8)	113 (18.0)	36 (5.6)	68 (10.5)	70 (10.7)	56 (8.0)
<b>MALAYSIA</b>	332 (12.3)	56 (2.0)	74 (2.7)	1 603 (54.4)	1 868 (63.7)	182 (6.1)	222 (7.3)	1 281 (42.6)
<b>MONGOLIA</b>	31 (11.7)	8 (3.0)	7 (2.6)	0 (0)	0 (0)	0 (0)	0 (0)	20 440 (7160)
<b>NEW ZEALAND</b>	15 (3.6)	253 (59.3)	48 (11.2)	599 (135.7)	55 (12.3)	13 (2.9)	274 (60.2)	13 (2.9)
<b>PAPUA NEW GUINEA</b>	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	7 (1)	2 589 (345.9)	53 (6.9)
<b>PHILIPPINES</b>	874 (9.7)	1 485 (16.1)	6 388 (68.2)	6 555 (69.1)	1 536 (15.9)	5 798 (59.1)	54 669 (548)	2 003 (19.7)
<b>REPUBLIC OF KOREA</b>	2 (0)	17 (0.4)	111 (2.3)	43 (0.9)	2 (0)	107 (2.2)	442 (9.0)	7 (0.1)
<b>SINGAPORE</b>	18 (4.0)	16 (3.4)	54 (11.2)	143 (27.6)	40 (7.6)	66 (12.5)	171 (32.0)	45 (8.9)
<b>VIET NAM</b>	259 (2.9)	5 221 (59.3)	1 826 (20.5)	745 (8.4)	637 (5.9)	1 232 (13.6)	16 741 (182.8)	605 (6.5)
<i>Pacific island countries/areas</i>	0 (0)	4 (4.7)	1 (0.3)	2 (1.0)	0 (0)	0 (0)	278 (85.0)	20 (6.1)
<b>Western Pacific Region</b>	<b>145 934</b> (81.6)	<b>61 291</b> (34.0)	<b>48 490</b> (27.0)	<b>21 088</b> (11.7)	<b>10 794</b> (5.9)	<b>35 700</b> (19.5)	<b>128 786</b> (70.1)	<b>67 518</b> (36.0)

Source: Adapted from National measles and rubella monthly reports as of 3 May 2016.

### *Increased importation of measles virus from measles endemic countries*

Multiple importations of measles virus followed by small-scale outbreaks were reported in 2013–2015 from Australia, Hong Kong SAR (China), Japan, New Zealand, the Republic of Korea, Singapore and Vanuatu, resulting in increased imported- and import-related measles incidence in these countries.

### *Nationwide measles outbreaks after importation*

Several countries experienced large-scale outbreaks following importation after a period of low or no documented transmission: New Zealand (due to genotype B3 in 2013–2014), Viet Nam (due to genotype H1, B3 and D8 virus in 2013–2014), Papua New Guinea (due to genotype D8 virus imported from Indonesia in 2013 and genotype B3 virus in 2014), the Federated States of Micronesia (due to genotype B3 virus in 2014), Solomon Islands (due to the genotype B3 virus imported from Papua New Guinea in 2014), the Lao People's Democratic Republic (due to genotype H1 virus in 2014) and Mongolia (due to genotype H1 virus in 2015–2016).

Importations resulted in large-scale measles outbreaks in 2013–2016 and revealed that several countries had sustained large-scale residual or accumulated susceptible populations (for example, the Lao People's Democratic Republic, Mongolia, Papua New Guinea, Solomon Islands and Viet Nam).

### *Re-established measles virus transmission after elimination*

In Mongolia, which was verified by the RVC in March 2014 to have achieved and sustained interruption of endemic measles virus transmission for more than three years, a prolonged nationwide measles outbreak started in March 2015 due to imported genotype H1 virus, leading to classification by RVC as having re-established endemic transmission as of September 2017.

## 7. Unresolved issues and emerging challenges

This chapter describes unresolved issues and emerging challenges identified during the measles resurgence and large-scale outbreaks in 2013–2016, which should be urgently addressed by countries and areas of the Western Pacific Region in order to achieve and sustain regional measles and rubella elimination. Proposed strategies specifically addressing each of these issues and challenges will be detailed in Chapter 9.

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### 7.1 Unresolved issues

#### *Immunization system*

The overall immunization system in every country and area in the Western Pacific Region has continued to improve since the launch of the Regional Polio Eradication Initiative in the 1990s and initiation of the regional measles elimination effort in 2003. However, the following issues have been observed and reported in several countries by external monitors during recent mass vaccination campaigns and/or by international reviewers during recent international EPI reviews:

- insufficient or weak supply chain systems and practices; and
- inappropriate practices in vaccine management, injection, immunization safety and waste management.

**These issues are addressed by Strategies 1.3 and 1.4.**

#### *Population immunity among children targeted by the current immunization strategy*

Age groups that were targeted by routine immunization programmes and/or SIAs still had high measles virus transmission in several countries, even in countries that reported high vaccination coverage of MCV1, MCV2 and MCV SIAs:

- children aged less than 2 years – age groups to be protected by the routine MCV1 and by the routine MCV2 or MCV SIAs in some countries;
- children aged 2–5 years – age groups to be protected by the routine MCV1 and either MCV2 or MCV SIAs; and/or
- school-age children – age groups that should be previously vaccinated by two routine doses or be protected by SIAs if the routine immunization programme does not achieve sufficiently high immunity prior to school entry.

In these countries, significant numbers of infants and young children continue to miss opportunities to be vaccinated and susceptible children quickly accumulate in each birth cohort. As result, population immunity is not high enough to achieve and sustain the interruption of measles virus transmission even though the vaccination coverage has been reported to exceed >95%.

**These issues are addressed by Strategies 2.1, 2.2, 2.3 and 2.4.**

### *Epidemiologic surveillance*

While all 37 countries and areas in the Western Pacific Region have established and are running case-based measles surveillance to monitor and analyse details on measles epidemiology with WHO and other Member States, rubella is not universally a reportable condition. As some countries and areas only use the case definition for measles, surveillance sensitivity for rubella is insufficient. In addition, there are still many provinces and districts in several countries with:

- low sensitivity in surveillance, that is, low “reporting rate at second administrative level” in several countries;
- insufficient capacity for case investigation, that is very low “proportion of suspected cases with adequate investigation initiated within 48 hours of notification” in several countries; and/or
- insufficient capacity for collection and shipment of adequate specimens from each outbreak or transmission, that is low “proportion of suspected measles and rubella cases with adequate specimens” in several countries.

**These issues are addressed by Strategies 3.1, 3.2, 3.3 and 3.4.**

### *Laboratory support*

The Regional M&R LabNet was established in 1998 and the GSL and all of the RRLs and NMRLs are achieving accreditation standards and maintaining the quality of the network. However, some NMRLs could not conduct serological tests or report the results of all specimens in a timely manner during the large-scale measles outbreaks due to the high volume of samples received.

Virological (genotype) information is not available in all countries and areas. Submission of monthly virologic data from some countries to the Regional Office for the Western Pacific tends to be delayed, resulting in delays to share regional virological information with Member States and other WHO regions. High staff turnover at NMRLs, insufficient staffing and lack of proper training may contribute to decreased laboratory testing capacity. Distribution of proficiency testing panels to NMRLs and shipment of samples for confirmatory testing to RRLs is sometimes delayed due to complex national customs regulations and clearance processes.

**These issues are addressed by Strategies 4.1, 4.2 and 4.3.**

### *Transmission of measles virus among areas with high reported vaccination coverage*

Several countries with a resurgence or large-scale outbreak of measles had large numbers of cases among populations with high estimated coverage of routine MCV administrations and/or MCV SIAs. This suggests an inadequate awareness of high-risk areas, communities and populations. Risk assessments by immunization programmes often rely on reported coverage over measured population immunity, leading to underestimation of susceptible individuals.

**These issues are addressed by Strategy 5.1.**

### *Rubella elimination*

The Region in 2014 resolved to eliminate rubella with the endorsement of the *Regional Framework for Implementation of Global Vaccine Action Plan in the Western Pacific*, specifying the eight regional immunization goals, including regional rubella elimination.

Several countries in the Western Pacific region experienced nationwide outbreaks or increased transmission of rubella between 2000 and 2015, including: Mongolia (2000–2001, 2006–2007); Philippines (2001, 2007, 2009–2011); Niue (2003); Singapore (2003); Fiji (2002–2003); Viet Nam (2005–2007, 2010–2012, 2015); China (2008); Lao People's Democratic Republic (2009, 2011); Cambodia (2008, 2011–2012); Samoa (2009); Australia (2011); New Zealand (2011); Malaysia (2012–2013); and Japan (2012–2014).

Issues to be addressed for making further progress towards rubella elimination are:

- CRS surveillance, which has been not yet established in many countries, resulting in an underestimation of CRS burden in several countries and areas of the Region; and
- some countries give RCV with MCV2, but the coverage of MCV2 is much lower than the coverage of MCV1.

**These issues are addressed by Strategies 2.1, 3.5 and 8.1. Strategies and activities for addressing other issues related to immunization and surveillance for rubella elimination are proposed in Strategies 2.1 to 2.6 and 3.1 to 3.5, respectively**

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## 7.2 Emerging challenges

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### *Changing measles epidemiology*

Several countries have experienced changes in measles epidemiology and the age distribution of measles cases, such as increased incidence among: (i) infants too young to be vaccinated, due in part to declining maternal immunity; and (ii) adolescents and adults not targeted by the current immunization strategies, that is, routine childhood immuni-

zation and traditional SIAs. In countries with large populations (for example, more than 50 million people), measles epidemiology (for example, age distribution of measles cases) has become more varied within countries (for example, province by province) in the recent resurgence. In these countries, a single unified immunization strategy such as a national SIA, targeting a given age group throughout the country, may have less impact than targeted strategies implemented at subnational levels.

**These emerging challenges are addressed by Strategies 1.1 and 1.2.**

### *Immunization programme gaps*

Several countries, although they have reported high coverage of MCV1, MCV2 and MCV SIAs at the national level and/or repeatedly conducted MCV SIAs, were seriously affected by resurgence of endemic measles virus transmission or large-scale measles outbreaks following importation. This suggests that, in several countries, the target population estimated or projected for the routine immunization programme is not reliable enough to be used as a coverage denominator and/or SIAs continue to miss children that were missed by the routine immunization programmes, leading to a large residual susceptible population. In some countries, specific communities and/or groups have continued to be affected by measles outbreaks, which have resulted in large-scale measles outbreaks, with increased measles virus transmission noted among adults. Although the RVC made country-specific recommendations to each NVC in 2014 and 2015 for making further progress towards measles elimination by addressing these challenges, these recommendations may not have been fully implemented by the national measles and rubella elimination programmes in all countries.

**These challenges are addressed by Strategies 1.1, 2.5, 2.6, 5.1 and 8.2.**

### *Inadequate planning and capacity for outbreak preparedness and response*

It was recognized in several countries that sufficient outbreak response capacity had not yet been established at the national and provincial levels. As a result, (i) outbreak detection and investigation has been not carried out promptly and properly, and (ii) outbreak response immunization has been not carried out promptly or with adequate scope to interrupt measles virus transmission. It was also pointed out in some countries that investigation materials and contingency funds for outbreak investigation were inadequate at the provincial or district levels and that delays in disbursement from the national level resulted in delays in outbreak investigation. Other but more critical challenges are becoming more apparent in several countries, including: (i) measles transmission and outbreaks amplified in hospitals and by health staff (that is, nosocomial transmission); and (ii) high case fatality among young infants.

**These emerging challenges are addressed by Strategies 6.1, 6.2, 6.3, 6.4, 6.5 and 6.6.**



## Proposed regional strategy for measles and rubella elimination in the Western Pacific

All countries and areas in the Western Pacific Region by 2012 had significantly strengthened national immunization programmes and had made considerable progress towards the regional elimination goal through implementation of measles elimination strategies and activities that began with the launch of the regional elimination initiative in 2003.

While the regional measles emergence in 2013–2016 hampered the Region from achieving the elimination goal, detailed analysis on the resurgence has helped the Region specify unresolved issues and emerging challenges to be addressed urgently to achieve and sustain measles and rubella elimination in all countries and areas in the Western Pacific Region.

To address and overcome these unresolved issues and emerging challenges and ensure that interruption of the transmission of the measles and rubella viruses will be achieved and sustained in all countries and areas of the Region, this section, first, reaffirms the goals and strategic objectives for the regional measles and rubella elimination in the Western Pacific, and proposes targets to be achieved by the year 2020 – the target year of the Decade of Vaccines and the *Regional Framework for Implementation of Global Vaccine Action Plan in the Western Pacific* (Chapter 8). Then, the section proposes strategies and activities in each of the eight strategic areas (Chapter 9) in order to address and overcome the unresolved issues and emerging challenges described in Chapter 7 and to achieve the targets by 2020 proposed in Chapter 8.

Unresolved issues and emerging challenges vary country by country, while the regional goal is common for all as determined by the WHO Regional Committee for the Western Pacific in 2003, 2005 and 2014. Therefore, it is proposed that each country and area of the Region, especially those that experienced a resurgence, large-scale outbreak or re-establishment of endemic virus transmission following a period of low or no documented incidence, perform an assessment of the issues and challenges that it has been facing. Guided by this assessment, each country and area is encouraged to prepare or update its own national plan of action for measles and rubella elimination, incorporating the strategies and activities from this document that are most suitable.

The Proposed Framework for National Plan of Action (Appendix 6) summarizes the strategic areas, issues and challenges, strategic targets, and proposed activities detailed in Chapter 9 to assist countries and areas to update or develop their national measles and rubella elimination strategies and plans, with full consideration of their specific issues and challenges. WHO will continue to support each country and area to determine which strategies and activities are most suitable for their individual situation and the state of progress towards elimination of measles and rubella, and to develop and implement its national plan of action, guided by this document.

## 8. Regional goal, strategic objectives and targets

### 8.1 Regional goal

Achieve and sustain the elimination of measles and rubella (interruption of the transmission of the measles and rubella viruses) in all countries and areas of the Western Pacific Region.

### 8.2 Strategic objectives

1. Aim to achieve and sustain interruption of the transmission of endemic measles and rubella viruses in the Western Pacific Region.<sup>9</sup>
2. Prevent re-establishment of the transmission of imported measles and rubella viruses.
3. Strengthen national immunization programmes through measles and rubella elimination initiatives.<sup>10</sup>
4. Support other health interventions through implementation of measles and rubella elimination strategies and activities.<sup>11</sup>

### 8.3 Operational targets by 2020\*

\* the target year for the Decade of Vaccines and Global Vaccine Action Plan

#### *Achieve measles elimination*

1. Resurgence of endemic measles virus transmission prevented (genotype B3, D8, D9 and H1).
2. All ongoing measles transmission interrupted in endemic countries.

9. See WPR/RC68.R1: The Regional Committee decided that all Member States in the Region aim to eliminate rubella as soon as possible and establish a target year for each country or area, based on country or area context.

10. See WPR/RC54.R3: The Regional Committee decided that, in the Western Pacific Region, measles elimination and hepatitis B control should be the two new pillars to strengthen the EPI.

11. See WPR/RC54.R3: The Regional Committee urged Member States to use measles elimination strategies to strengthen EPI and other public health programmes.

3. Interruption of measles virus transmission achieved in countries and areas approaching measles elimination and sustained in countries and areas having reached measles elimination.
4. Large-scale outbreaks, after importation, prevented.
5. Verification-standard measles surveillance<sup>12</sup> supported by WHO-accredited laboratories established and maintained in all countries and areas of the Region.

#### *Make progress towards rubella elimination*

1. Regional verification guidelines for rubella elimination developed (by 2018).
2. A national target year for rubella elimination set in all countries.
3. National strategies and plan of action for rubella elimination developed in all countries.
4. CRS surveillance established in all countries.

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## **8.4 Eight strategic areas for proposing strategies and activities to reach operational targets by 2020 and achieve strategic objectives**

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### **Strategic area 1. Overall planning and immunization system**

### **Strategic area 2. Immunization**

### **Strategic area 3. Epidemiologic surveillance**

### **Strategic area 4. Laboratory support**

### **Strategic area 5. Programme review and risk assessment**

### **Strategic area 6. Outbreak preparedness and response**

### **Strategic area 7. Partnership, advocacy, IEC and social mobilization**

### **Strategic area 8. Progress monitoring and verification of elimination**

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12. See Page 6 of the *Guidelines on Verification of Measles Elimination in the Western Pacific Region* (2013).

## 9. Strategies and activities by strategic area

### Strategic area 1

#### Overall planning and immunization system

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##### Strategy 1.1

##### Update the national strategies and plans of action for measles and rubella elimination

###### Issues or challenges

- Several countries with reported high coverage of MCV1, MCV2 and MCV SIAs at the national level were affected by large-scale measles outbreaks or re-establishment of endemic measles virus transmission.
- Several countries experienced changing epidemiology in the age distribution of measles cases in recent measles outbreaks (for example, increased incidence among infants too young to be vaccinated, as well as among adolescents and adults not targeted by the current strategies).
- Several countries have not yet developed a national strategy and plan of action for rubella elimination although they introduced RCV into the national immunization programme and the WHO's Regional Committee for the Western Pacific determined regional rubella elimination as one of regional immunization goals for the Western Pacific.
- Similar to the situation with measles, several countries experienced changing epidemiology in the age distribution of rubella cases. Age of infection shifting towards older age groups could be a particular concern because of the higher risk of CRS.

###### Strategic target

- Updated national strategies and plans of action for measles and rubella elimination.

###### Proposed activities

- Conduct thorough analysis on causes of re-establishment of endemic measles virus transmission or large-scale measles outbreaks in 2013–2016.
- Conduct thorough analysis of recent rubella outbreaks and identify risks factors.
- Identify people and groups at increased risk for acquiring measles, through careful characterization of unvaccinated persons and barriers to vaccination.
- Organize national consultations, with partners if appropriate, to update national plans and strategies for measles and rubella elimination.

### **Successful experiences**

- The Republic of Korea, which experienced a nationwide measles outbreak in 2000–2001, developed a new national plan and strategies and started its implementation during the outbreak.
- Japan, which experienced a nationwide measles outbreak in 2007, developed a new national plan and strategies in 2007, and started their implementation in 2008.
- New Zealand, where measles transmission was re-established in 2011, developed and implemented new strategies and most likely interrupted re-established measles transmission in 2012.

## **Strategy 1.2**

### **Develop subnational (for example, provincial or regional) plans and strategies for measles and rubella elimination in countries with large populations**

#### **Issue or challenge**

- Measles epidemiology (for example, age distribution of measles cases) has varied within countries in recent resurgence.

#### **Strategic target**

- Subnational plan and strategies developed in each second-level administrative area with full consideration of area-specific situations.

#### **Proposed activities**

- a. Conduct thorough analysis on causes for resurgence of endemic measles virus transmission or large-scale measles outbreaks in 2013–2016, region by region or province by province (for countries with a large population).
- b. Identify people and groups at increased risk for acquiring measles, characteristics of unvaccinated persons and barriers to vaccination.
- c. Organize national consultations and training, with partners if appropriate, for developing subnational plan and strategies for measles and rubella elimination in each administrative area with more than 1 million population.

### **Successful experiences**

- Guizhou province in China, one of the country's least-developed provinces with the highest incidence of measles in 2002, initiated a seven-year project from 2003–2009 to strengthen routine immunization services, enforce school entry immunization requirements, conduct SIAs and enhance measles surveillance, which resulted in an increase in routine MCV1 and MCV2 coverage, and a decrease in annual measles incidence from 200–300 per million in 2003 to 0.9–2.2 per million in 2010–2013.

- Japan encouraged each of 47 prefecture governments in the country to develop a prefecture measles elimination committee and a prefecture measles elimination plan and delegated implementation of measles elimination activities to the prefecture measles elimination committee.

### **Strategy 1.3**

#### **Establish and sustain supply chain system and practices strong enough for measles and rubella elimination activities**

##### **Issue or challenge**

- Insufficient or weak supply chain system and practices were observed and reported in several countries by external monitors during recent mass vaccination campaigns and/or by international reviewers during recent national EPI reviews.

##### **Strategic target**

- No stock-outs, and in-time and proper distribution of vaccines and all ancillaries at all levels for both routine immunization programmes and mass vaccination campaigns.

##### **Proposed activities**

- Ensure regular assessments of cold chain inventory, functionality and needs at each level.
- Ensure timely and accurate forecasting.
- Secure adequate financial and operational resources for vaccine procurement, repair, maintenance or replacement of cold chain infrastructure, and timely distribution of vaccines and ancillaries.
- Ensure timely procurement of needed cold chain supplies and equipment and adequate maintenance and repair of cold chain equipment at all levels.
- Ensure timely procurement of sufficient vaccines.
- Proactively conduct monitoring and communications on vaccine delivery throughout the supply chain to prevent vaccine stock-outs at all levels.
- Ensure a mechanism is in place to provide and document catch-up vaccination if coverage is interrupted due to stock-outs.
- Periodically conduct effective vaccine management assessments and update implementation plans based on assessment findings.

## **Strategy 1.4**

### **Further improve immunization practices**

#### **Issues or challenges**

- Inappropriate practices for vaccine, injection (for example, subcutaneous MRCV administered incorrectly as an intramuscular injection), immunization safety and waste management, and false contraindications to vaccination were observed and reported by external monitors during previous mass vaccination campaigns in several countries.
- Insufficient preparedness for adverse events following immunization (AEFIs) and weak AEFI monitoring was also observed and reported by external monitors during previous mass vaccination campaigns in several countries.

#### **Strategic targets**

- Needle-stick injuries avoided at all health care facilities.
- No AEFIs due to immunization-related error in the national immunization programme.
- All serious AEFIs investigated thoroughly and managed properly.
- Immunization-related medical waste properly managed at all health care facilities and communities.
- Eligible children are not denied vaccination in routine and mass vaccination campaigns due to false contraindications.

#### **Proposed activities**

- a. Regularly conduct training for the staff at all levels on safe injection practices, safe waste management, and correct eligibility criteria and contraindications for vaccination.
- b. Regularly conduct training for the staff at all levels on functional surveillance and response to AEFIs.

## Strategic area 2

### Immunization

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#### Strategy 2.1

#### Optimize MCV1, MCV2 and RCV schedules for measles and rubella elimination

##### Issues or challenges

- Some countries give a first dose of RCV with MCV2, the coverage of which is much lower than the coverage of MCV1.
- In several countries, children aged 2–5 years experienced increased measles virus transmission.

##### Strategic targets

- All countries and areas give two doses of MRCV in their national immunization programme.
- MRCV2 given during the second year of life with high coverage in countries where children aged 2–5 years were affected during the recent measles resurgence or outbreaks.

##### Proposed activities

- Change the national immunization schedule to:
  - give the first dose of RCV with the first dose of MCV as MR vaccine or MMR vaccine at 9 months; and
  - give MCV2 before the second birthday, that is at age 15–18 months. (1)
- Improve coverage of MRCV1 and introduce MRCV2, for countries that have not yet introduced MRCV2 if > 80% coverage with MRCV1.

#### Strategy 2.2

#### Establish and maintain high-enough population immunity to achieve and sustain interruption of measles and rubella virus transmission among children < 24 months old by an intensified routine immunization programme

##### Issues or challenges

- Children aged less than 2 years were affected by increased measles virus transmission in several countries.
- Children born after the previous MCV SIA experienced increased measles virus transmission in several countries during the recent measles resurgence or outbreaks.

##### Strategic target

- All children provided with both MRCV1 and MRCV2 before their second birthday.

### **Proposed activities**

- a. Ensure all infants are provided with a national vaccination card.
- b. Ensure all vaccinations are registered in the immunization registry at the time of each administration.
- c. Ensure all children under 2 years of age are monitored on vaccination history by vaccination card and/or vaccination record book.
- d. Ensure all children are given opportunities for receiving two doses of MRCV by their second birthday by the routine vaccination programme or high-risk-group SIA, or during the National Immunization Week or through enhanced RED/REC strategies.
- e. Conduct complementary activities to verify high population immunity through cross-sectional serological surveys, such as testing convenience samples (for example, blood bank samples) or conducting representative surveys for the whole country or high-risk geographical areas if feasible.

### **Strategy 2.3**

**Establish and maintain high-enough population immunity to achieve and sustain interruption of measles and rubella virus transmission among preschool-age children by catch-up vaccination at entry to child care services and/or by periodic follow-up SIA**

#### **Issue or challenge**

- Children aged 2–5 years experienced increased measles virus transmission in several countries during the recent measles resurgence or outbreaks.

#### **Strategic target**

- All unvaccinated children detected and provided with an opportunity for full vaccination status before entry to day care/preschool/kindergarten.

#### **Proposed activities**

- a. Promote vaccination history checks at entry to day care/preschool/kindergarten.
- b. Encourage requirements for vaccination before entry to day care/preschool/kindergarten.
- c. Conduct periodic follow-up SIAs every three to four years unless Strategy 2.2 and Activity d) under that strategy are fully implemented.

#### **Successful experience**

- Cambodia achieved and sustained interruption of measles virus transmission with frequent MCV SIAs (targeting children aged 9–59 months in 2007 and in 2011, children aged 9 months to 15 years in 2013, and those aged 5–59 months in 2016).

## Strategy 2.4

### Establish and maintain high-enough population immunity to achieve and sustain interruption of measles and rubella virus transmission among schoolchildren

#### Issue or challenge

- School-aged children still experienced measles virus transmission in several countries during the recent measles resurgence or outbreaks.

#### Strategic target

- Neither measles nor rubella outbreaks occur among school children or in any school.

#### Proposed activities

- Promote vaccination history checks at entry to all schools (from elementary to college).
- Encourage school-entry requirement of vaccination for all schools (from elementary to college).
- Develop and conduct school-based vaccination programmes for non-fully vaccinated students at entry to any school.
- Periodically conduct selective MRCV SIA for schoolchildren that are non-fully vaccinated (for example during national immunization week).
- Conduct non-selective MRCV SIAs when an outbreak is detected among school children.

#### Successful experiences

- The Republic of Korea initiated a school-entry requirement for vaccination certificate of MCV2 in collaboration with the Ministry of Education in 2001. It helped in identifying unvaccinated populations and increasing the vaccination coverage.
- In April 2008 to March 2013 (five years), Japan targeted all students aged 13 years (Grade 1 of junior high school) and 18 years (Grade 3 of senior high school) with a chance of MR any day at that age for one year and, as of May 2013, vaccinated with MR 83.3% on all children who were born in 1990–1999.

## Strategy 2.5

### Prevent measles and rubella virus transmission among young adults and in workplaces

#### Issues or challenges

- Adults experienced measles virus transmission in several countries during the recent measles resurgence or outbreaks.
- Recently, large-scale rubella outbreaks occurred among young adults in workplaces in several countries.

### Strategic target

- Measles and rubella outbreaks prevented or contained at small scale among young adults or in any workplace or confined settings (for example, dormitories, factories).

### Proposed activities

- a. Engage relevant sectors (for example, education, occupational health, military, regulatory authorities for labour and social security, transportation, etc.) in collaborative activities for prevention of measles and rubella outbreaks among young adults or in any workplace or confined setting.
- b. Promote vaccination with MRCV for targeted adult groups living or working in communal settings (for example, students, health workers, factory workers, transportation and hospitality workers, military personnel, police and others, at entry to colleges, universities and workplaces).
- c. Conduct selective MRCV SIAs for high-risk adult groups (for example migrants to urban slums, seasonal workers).
- d. Conduct one-time, non-selective speed-up MRCV SIAs<sup>13</sup> for countries with small populations.
- e. Incorporate mass measles-rubella vaccination into a wide-age-range (for example, 15–44 years) tetanus toxoid SIAs for women of reproductive age conducted for maternal and neonatal tetanus elimination (MNTE), excluding pregnant women.
- f. Promote immunization requirements before international travel from/to endemic countries.

### Successful experiences

- Solomon Islands conducted a non-selective wide-age-range MRCV SIA targeting those 6 months to 30 years of age in September to December 2014 in response to a nationwide measles outbreak that began in July 2014. The SIA vaccinated 398 622 people, which was more than the estimated target population.
- Mongolia conducted a non-selective wide-age-range MRCV SIA targeting those 18–30 years in May 2016 in response to a nationwide measles outbreak that began in 2015. Reported vaccination coverage reached 88.1%.

## Strategy 2.6

### Prevent measles and rubella outbreaks in high-risk populations, communities or groups

#### Issue or challenge

- Specific communities or groups in some countries have continued to be affected by outbreaks and have triggered large-scale measles outbreaks.

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13. A speed-up MRCV SIA is a one-time campaign that targets older children, adolescents and adults (the age group of males and females to be vaccinated depends on which year the vaccine is introduced, the coverage of follow-up campaigns, epidemiology and fertility rates in the country) (Rubella vaccines: WHO position paper. Wkly Epidemiol Rec. 2011;86:301–16).

### Strategic targets

- High-risk communities or groups identified and provided with opportunities for vaccination.
- Measles and rubella outbreaks prevented in high-risk communities or groups.

### Proposed activities

- a. Develop and conduct special communications and immunization strategies tailored for high-risk groups (for example, ethnic minority groups, migrants, religious objectors, nomads and remote areas) identified by analysis of data from surveillance and outbreak investigations.
- b. Proactively take corrective actions to fill immunity gaps (for example, selective immunization activities or smaller scale, such as regional or province-wide, SIAs targeting appropriate age groups; or more frequent follow-up SIAs targeting birth cohorts born after the last SIA in specific regions or provinces), based on country-level data. In outbreak settings, children 6 months of age and older should be vaccinated.
- c. Promote development of micro-plans in every district for both routine and supplemental immunization service delivery, (following the Reaching Every District strategy [WHO, 2009. WHO/IVB/09.11]).

### Reference

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1. Measles vaccines: WHO position paper. *Wkly Epidemiol Rec.* 2009;84:349–60.

## Strategic area 3

### Epidemiologic surveillance

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#### Strategy 3.1

#### Establish nationwide case-based integrated acute fever and rash (AFR) surveillance for measles and rubella

##### Issues or challenges

- Rubella is not a reportable condition in some countries and areas.
- Some countries still use a suspected case definition for measles only, which is insufficiently sensitive for rubella.

##### Strategic targets

- Surveillance systems are designed to detect and report all cases of acute rash illness and fever that could be measles or rubella.
- Samples are collected and tested for measles and rubella using an integrated strategy.

##### Proposed activities

- a. Change surveillance case definition to acute fever and rash, if feasible.<sup>14</sup>
- b. Samples collected to investigate cases of acute fever and rash illness should be tested for rubella if found negative for measles, or tested simultaneously for measles and rubella.

#### Strategy 3.2

#### Ensure all suspected measles and rubella cases are detected and reported by all health facilities

##### Issue or challenge

- There are still many provinces and districts with low sensitivity in surveillance (low “reporting rate at the second administrative level”).

##### Strategic target

- Percentage of second-administrative-level reporting at least two non-measles, non-rubella cases per 100 000 population per year  $\geq 80\%$ .

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14. Countries with high incidence of non-measles, non-rubella fever with rash illnesses may wish to consider leveraging existing surveillance networks, for example dengue or Zika, if applicable. Staged introduction of integrated AFR surveillance, for example, focusing initially on high-risk populations, may also be appropriate strategies in some settings.

**Proposed activities**

- a. Ensure sufficient capacity at all health facilities including private health facilities and health centres for prompt detection and reporting of all AFR cases (for example by regular training, supportive supervision visits).
- b. Conduct intersectoral advocacy, programme communications and social mobilization to promote prompt detection and reporting of all AFR cases of all ages. This includes systematically engaging the private health sector, such as national or regional associations of health-care providers.
- c. Improve linkage of AFR surveillance with existing surveillance networks (for example, Early Warning Alert and Response Network, surveillance for influenza, dengue, Zika, etc.).
- d. Encourage all provinces and districts to conduct active case searches not only when an outbreak is detected or suspected but also as part of regular surveillance performance assessment.
- e. Conduct routine monitoring and supervision to ensure quality of surveillance data.
- f. Provide regular feedback of surveillance data and performance to all levels of the system.

**Strategy 3.3****Establish sufficient capacity for adequately investigating suspected measles and rubella cases in all provinces and districts****Issue or challenge**

- There are still many provinces and districts with insufficient capacity for adequate case investigation (very low “proportion of suspected cases with adequate investigation initiated within 48 hours of notification”).

**Strategic target**

- Percentage of suspected measles and rubella cases with adequate investigation (1) initiated within 48 hours of notification  $\geq$  80%.

**Proposed activities<sup>15</sup>**

- a. Ensure sufficient capacity at national, provincial and district levels for prompt and adequate investigation of AFR cases and management and analysis of data (for example, by regular training, supportive supervision visit).
- b. Secure adequate operational resources to ensure case investigation with collection and transport of specimens for case confirmation and virus detection.
- c. Ensure case investigation includes use of a common unique identifier to link laboratory and epidemiologic data.

15. Countries and areas are recommended to prioritize support for silent and under-reporting districts, guided by ongoing performance monitoring and analysis.

- d. Encourage all provinces and districts to conduct active case searches not only when an outbreak is detected or suspected but also as part of a regular surveillance performance assessment.
- e. Ensure investigation of measles and rubella cases during both routine surveillance and outbreak investigation is able to classify cases as: 1) imported or import-related; and 2) preventable or non-preventable.
- f. Conduct routine monitoring and supervision to ensure the quality of surveillance data.

### Successful experience

- Cambodia experienced an importation-related measles outbreak in 2016–2017 after the country was verified as having eliminated measles in 2015. Sixty-five cases were confirmed out of 960 suspected measles cases reported from 24 provinces between 1 January 2016 and 31 March 2017. Lessons learnt for sustaining measles elimination status include: (i) immediate investigation; (ii) enhanced surveillance activities throughout the country; (iii) standard process for contact tracing; (iv) immediate communication with provinces, local authorities and communities; (v) prompt assessment and plan for timely immunization response activities; and (vi) immediate outbreak response immunization.

## Strategy 3.4

### Establish sufficient capacity for collecting and shipping specimens from suspected measles and rubella cases from each outbreak or transmission in all provinces and districts

#### Issue or challenge

- There are still many provinces and districts with insufficient capacity for collecting and shipping adequate specimens from each outbreak or transmission (low “proportion of suspected measles and rubella cases with adequate specimen”).

#### Strategic target

- Percentage of suspected measles and rubella cases with adequate specimens for detecting acute measles or rubella infection collected and tested in a proficient laboratory  $\geq 80\%$ .

#### Proposed activities

- a. Ensure sufficient capacity at provincial and district levels for collecting adequate and appropriate specimens<sup>16</sup> (for example, by regular training, supportive supervision visits) for both serologic and molecular tests, at first contact with suspected cases.

16. Serum or oral fluid for serologic test, and throat swab, oral fluid or urine for molecular test. Adequate blood specimen: while IgM ELISA tests are more sensitive between days four and 28 after the onset of rash, a single serum sample obtained at the first contact with the health care system within 28 days after onset is considered adequate for measles surveillance (WHO-recommended standards for surveillance of selected vaccine-preventable diseases). For virus isolation, adequate throat swabs should be collected within five days after the onset of rash for measles and within three days after the onset of rash for rubella.

- b. Secure adequate operational resources to ensure case investigation with collection and transport of specimens for case confirmation and virus detection.
- c. Ensure laboratory resources are efficiently used, by increasing appropriate use of epidemiologic linkage for case confirmation during large outbreaks.
- d. Encourage all provinces and districts to conduct active case searches not only when an outbreak is detected or suspected but also as part of a regular surveillance performance assessment.
- e. Conduct routine monitoring and supervision to ensure the quality of surveillance data.

### Successful experience

- The measles and rubella surveillance system functioned very well in China, with high surveillance performance indicators even during the nationwide measles resurgence in 2013–2016. This was enabled by: (i) strong Government funding and policy support; (ii) strong leadership from the Chinese Center for Disease Control and Prevention (China CDC) and the national/regional reference laboratory; (iii) continuous training and technical support; (iv) strong cooperation among the national, provincial, city and county levels of China CDC and laboratories; (v) establishment of effective quality control systems; and (vi) funding and technical support from WHO, China CDC, and other international and national organizations.

## Strategy 3.5

### Establish or expand congenital rubella syndrome (CRS) surveillance

#### Issue or challenge

- CRS surveillance has not yet been established in many countries of the Western Pacific Region, resulting in the CRS disease burden continuing to be underestimated in these countries and in the Region.

#### Strategic target

- CRS surveillance established.

#### Proposed activities

- a. Establish and eventually expand sentinel site surveillance for CRS (for example, at a national paediatric hospital, major provincial hospitals).
- b. Monitor and improve CRS surveillance performance using standard indicators.<sup>17</sup>

#### 16. *Continued*

Urine samples are not recommended for rubella. Throat swabs and urine can be collected up to 14 days after rash onset for RNA detection by RT-PCR, although RNA detection rates are much lower after seven days post-rash onset. For laboratory confirmation of CRS, IgM may remain detectable for up to one year although IgM detection is most reliable between 3–6 months of age. Beyond 6 months of age, testing for IgG is recommended to confirm CRS. The persistence of IgG antibodies beyond 6 months of age has been detected in 95% of cases.

### Successful experience

- Following a large nationwide rubella epidemic in 2011, Viet Nam implemented sentinel surveillance in CRS at national paediatric hospitals, which documented the burden of CRS and provided evidence to policy-makers for the introduction of RCV into the national routine immunization schedule.

### Reference

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1. Framework for verifying elimination of measles and rubella. *Wkly Epidemiol Rec.* 2014;88(9):89–99.

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17. The *Draft Strategic Plan for Accelerating Control of Rubella and Prevention of Congenital Rubella Syndrome in the Western Pacific Region* (2010) proposes use of measles surveillance performance indicators for rubella – that is, 1) discarded rubella rate of  $\geq 2$  per 100 000 population; 2) second level units with  $\geq 1$  discarded case per 100 000; 3) suspected cases with adequate investigation  $\geq 80\%$ ; 4) suspected cases with adequate blood specimens  $\geq 80\%$ ; and 5) laboratory results  $\leq 7$  days). However, standard indicators for CRS surveillance performance have not yet been endorsed for the Western Pacific Region and development of these should be considered a priority for the Region.

## Strategic area 4

### Laboratory support<sup>18</sup>

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#### Strategy 4.1

#### Ensure timely and appropriate laboratory diagnostic confirmation of suspected measles and rubella cases

##### Issues or challenges

- Some national measles and rubella laboratories (NMRLs) could not conduct serological testing of specimens and report results in timely manner during measles outbreaks.
- Some NMRLs were unable to efficiently integrate epidemiological and serological data due to lack of common unique identification numbers.
- Some NMRLs were overwhelmed by high numbers of laboratory samples collected during large measles outbreaks.

##### Strategic targets

- Within four days of receipt of specimens in the laboratory, serological testing is carried out for at least 80% of specimens received and these results are reported to the national immunization programme.
- Laboratory testing and epidemiologic linkage for case confirmation are used together in a sustainable way that allows maximization of laboratory resources following confirmation of outbreaks.
- All laboratory samples and epidemiological data collected during case investigation are labelled with the same unique identifier.

##### Proposed activities

- a. Ensure access to adequate laboratory equipment and sufficient supply of consumables (including testing kits), as well as budget for operational and shipping costs at NMRL.
- b. During large-scale outbreaks, ensure specimens are collected not from all, but from only selected suspected cases, (for example, from the first five to 10 suspected cases in a district or province for initial confirmation of an outbreak or from new areas of transmission, or if the outbreak lasts for more than 30 days to verify continued transmission).

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18. See WHO/IVB/09.03 for guidance on appropriate testing protocols for outbreaks to meet the following objectives: confirmation of outbreaks – to confirm the clinical diagnosis in the early stages of an outbreak; confirmation of cases – to confirm or discard any suspected cases of measles or rubella; and identification of measles and rubella viral strains and genetic characterization of viral isolates.

- c. Ensure that common unique identification numbers are used to identify laboratory samples and epidemiological data in all case investigations.
- d. Increase use of epidemiologic linkage during case investigations for routine case confirmation, during confirmed outbreaks, and in times and places where sample collection or transportation is extremely difficult, such as during disasters and remote locations.
- e. Ensure NMRL to conduct the external quality assessment programme for sub-national laboratories and monitor their performance to ensure quality and the timeliness of testing.

#### **Successful experience**

- China established 331 prefecture laboratories under 31 WHO-accredited provincial laboratories. These prefectural laboratories have helped with laboratory workload during the measles resurgence and contributed to timely confirmation of diseases and reporting. The measles and rubella laboratory network in China has supported surveillance activities and elimination programme across all levels – national, provincial and prefectural.

### **Strategy 4.2**

#### **Ensure collection of appropriate clinical specimens for obtaining genotype information from each outbreak and transmission**

##### **Issues or challenges**

- Virological (genotype) information and data have not been adequately obtained in some countries and areas.
- Submission of monthly virological data to WHO Regional Office for the Western Pacific from some countries tends to be delayed, which has resulted in delays for WHO in sharing regional virological information with Member States and other WHO regions.
- Appropriate clinical specimens (throat swabs or oral fluid) for genotyping are not always collected.

##### **Strategic targets**

- All NMRLs accredited for molecular detection to obtain and report genotype data monthly.
- All NMRLs to submit timely monthly case-based laboratory data (or line-lists) to the WHO Regional Office for the Western Pacific.

##### **Proposed activities**

- a. Ensure both serologic and virologic samples are simultaneously collected at the first contact with suspected cases.

- b. Ensure appropriate collection of adequate samples (throat swabs or oral fluid) for obtaining virological (genotype) data.
- c. Ensure sufficient budget for laboratory equipment, consumables, including reagents and kits, and operational and shipping costs.
- d. Ensure NMRLs without capacity for molecular analysis send representative samples to a RRL so that the country can obtain genetic information on both outbreaks and sporadic cases.
- e. Encourage NMRLs without throat swab or oral fluid samples to refer positive serum samples to a RRL to obtain genetic information from both outbreaks and sporadic cases to monitor elimination status.
- f. Collaborate with WHO in monitoring and providing feedback on timeliness and completeness of NMRL reporting to the WHO Regional Office for the Western Pacific.
- g. Ensure NMRL regularly shares data with the WHO Regional Office for the Western Pacific and submits genotype and sequence data to measles and rubella nucleotide surveillance databases (MeaNS and RubeNS).

### Strategy 4.3

#### Collaborate with the WHO Regional Office for the Western Pacific to further improve the performance of the Regional Measles and Rubella Laboratory Network

##### Issues or challenges

- Arrival of samples for proficiency testing (PT) at some NMRLs tends to be delayed due to time required for obtaining import permission.
- Submission of samples for confirmatory testing from some NMRLs to RRLs tends to be delayed.

##### Strategic targets

- All NMRLs in the Region are regularly updated on progress and issues in the Regional Measles and Rubella Elimination Initiative, as well as technical aspects of laboratory support to the initiative, in order to maintain and further improve the performance of the Regional Measles and Rubella Laboratory Network (M&R LabNet).
- GSL, RRLs and NMRLs continue to meet accreditation standards to maintain the quality of work of regional network laboratories.
- All NMRLs in the Region receive PT samples in a timely manner.
- ALL NMRLs submit samples for confirmatory testing to RRL in a timely manner.
- All NMRLs receive technical updates regularly through meetings, workshops and hands-on training.
- All NMRLs, RRLs and the GSLs are accredited.

**Proposed activities**

- a. Prepare timetable/schedule of PT samples distribution early and share with NMRLs.
- b. NMRLs secure import permit on time, in advance of the schedule of distribution of PT samples.
- c. Liaise with WHO country offices to facilitate receipt of PT samples by NMRLs.
- d. Ensure NMRLs send samples for confirmatory testing to RRL as per agreed schedule (once or twice a year).
- e. Evaluate results and provide recommendations to address significant problems.
- f. Conduct on-site review/desk review.
- g. Ensure laboratories implement recommendations made during the on-site/desk review.

## Strategic area 5

### Programme review and risk assessment

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#### Strategy 5.1

#### Detect programme deficiencies regularly and proactively, that is before a measles or rubella virus establishes transmission

##### Issue or challenge

- Several countries that had reported high MCV1 and MCV2 coverage and/or reported to have conducted successful MCV SIAs experienced a measles resurgence, or large-scale or multiple measles outbreaks following importation(s), likely caused by residual and/or accumulating susceptible populations.

##### Strategic targets

- Epidemiologic data are analysed, reported and used at both the local and country level to identify unvaccinated or under-vaccinated populations, and geographic areas that need special immunization strategies or increased support of the immunization system.
- High-risk areas, communities and populations with low immunization coverage are identified, specified and documented every year, and necessary proactive and corrective actions taken in time.

##### Proposed activities

- a. Conduct annual review of measles-rubella vaccination coverage (down to the lowest administrative unit), AFR surveillance data, surveillance performance indicators, and programme capacity (for example, cold chain, vaccine supply, human resources, financing) to identify programme deficiencies, communities at risk and immunity gaps by geographic area (for example, districts, health centre catchment areas) and by birth cohort.
- b. Conduct regular analysis of coverage data quality for both routine immunization programmes and mass vaccination campaigns.<sup>19</sup>
- c. Periodic serological surveys can be a useful complementary data point to validate vaccination coverage estimates, and provide a direct measurement of population immunity.
- d. Conduct regular analysis, at the local level as well as the country level, of the epidemiology of measles, rubella and CRS cases, outbreaks and chains of transmission,

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19. Reported vaccination coverage should be validated and poor performance identified during supervision visits through use of rapid convenience assessment (RCA), lot quality assurance sampling (LQAS) or 100 household surveys. Periodically 30-cluster coverage surveys and data quality self-assessments (DQS) should also be carried out.

using multiple complementary data sources, including coverage data, linked laboratory and epidemiologic data from integrated AFR surveillance, and genotyping data, to minimize the gaps in each individual data source. Existing tools, such as the WHO Programmatic Risk Assessment Tool for Measles,<sup>20</sup> may be useful to help in synthesizing data to identify high-risk districts, and generate summary results that can be used for advocacy, resource mobilization and prioritization of programmatic activities.

- e. Develop and implement special strategies addressing vaccine refusal/hesitancy and language or cultural barriers among minority populations and immigrant, mobile or other marginalized or socioeconomically disadvantaged population groups.
- f. Closely monitor epidemiologic situation of measles and rubella in countries from and to which travellers and migrants come and go.
- g. Regularly share the results of the risk assessments with the NVC and RVC, including data quality assessments.

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20. The WHO Measles Programmatic Risk Assessment Tool and user guide are available for download at [http://www.who.int/immunization/monitoring\\_surveillance/routine/measles\\_assessment](http://www.who.int/immunization/monitoring_surveillance/routine/measles_assessment).

## Strategic area 6

### Outbreak preparedness and response

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#### Strategy 6.1

##### Ensure standardized outbreak response procedures are in place at all levels

###### Issue or challenge

- Sufficient outbreak response capacity has not yet been established at the national and provincial levels in several countries.

###### Strategic target

- National plans and standardized operation procedures (SOPs) for outbreak response are developed or updated and disseminated to all stakeholders and health facilities in countries.

###### Proposed activities

- Develop or update a national plan for outbreak response, that includes emergency response infrastructure (including delineation of incident response hierarchy, subgroups and responsibilities, and pre-identified roles), SOPs (including procedures for response activation information management and flow, and response deactivation) and contingency planning (including surge capacity).
- Ensure all levels are provided with the national plan and SOPs for outbreak response.
- Conduct regular training for national, provincial and district staff to ensure all outbreak focal persons are familiar with the plan and SOPs.

###### Successful experience

- Japan updated or developed, and issued five national guidelines for: (i) Prefecture Measles Elimination Committee; (ii) Health Facilities on Prevention and Response to Nosocomial Measles Transmission; (iii) Schools on Prevention of and Response to Measles Outbreak at School; and (iv) Physicians on Notification of Suspected Measles Case; and (v) Epidemiologic Investigation of Suspected Measles Cases for Measles Elimination, over the country in 2008 right after it experienced a nationwide measles outbreak in 2007.

#### Strategy 6.2

##### Ensure necessary resources are in place before or right after an outbreak is detected

###### Issue or challenge

- Investigation materials and contingency funds for outbreak investigations were insufficient at the provincial or district levels and delays in disbursement from the national level led to delays in outbreak investigations in several countries.

### **Strategic targets**

- Outbreak investigation materials are made available at all provincial and district health offices.
- Contingency funds for outbreak investigation are secured at national level.

### **Proposed activities**

- a. Ensure all relevant materials for case investigation (for example, guidelines, case investigation forms, specimen collection supplies) are available to surveillance officers and clinicians in peripheral levels.
- b. Ensure contingency funds for outbreak investigation are available at the national level with prompt disbursement of the funds to the provincial or district levels when an outbreak is suspected.
- c. Ensure adequate laboratory support for timely testing and reporting.
- d. Identify personnel such as epidemiologists and other health-care professionals who can fill response roles as surge capacity when human resources are stressed during a large outbreak, to perform key activities such as contact tracing, case investigation, clinical management, laboratory testing and infection-prevention and control activities, appropriate with their professional background. This planning should also include development of procedures and mechanisms to activate, deploy and pay these personnel as part of outbreak preparedness planning.

## **Strategy 6.3**

### **Conduct prompt and thorough outbreak investigations**

#### **Issue or challenge**

- Outbreak investigations were not carried out promptly and properly in several countries.

#### **Strategic target**

- Capacity for appropriate outbreak investigations established at the national immunization programme, all provincial and district health departments.

#### **Proposed activities**

- a. Ensure protocols and training materials for surveillance and outbreak investigations are updated or developed to include critical data to be collected, criteria for laboratory confirmation, guidelines for analysis, interpretation of analysis results and presentation of the data.
- b. Ensure cases are investigated with collection of core variables<sup>21</sup> and specimens are appropriately collected and submitted to the laboratory.

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21. Twelve core variables are recommended by the WHO framework for verifying elimination of measles and rubella: 1) name or identifiers; 2) place of residence; 3) place of infection (to district level or lower); 4) age or date of birth; 5) sex; 6) date of rash onset; 7) date of specimen collection; 8) measles-rubella vaccination status; 9) date of last MR or MMR vaccination; 10) date of notification; 11) date of investigation; and 12) travel history.

- c. Ensure that investigations of measles and rubella cases during both routine surveillance and outbreak investigations are able to classify cases as: 1) endemic, imported or import-related; and 2) previously vaccinated or not vaccinated.
- d. Enhance active case search in the surrounding communities and alert clinicians about the suspected outbreak.
- e. Measure risk status in the affected and surrounding districts, and among high-risk groups.
- f. Carefully examine the age distribution of cases in order to appropriately target outbreak response measures.
- g. Identify epidemiologic linkage of cases (reduce the proportion of clinically compatible cases and increase the proportion of epidemiologically linked cases) and document chains of transmission.

#### **Successful experiences**

- Viet Nam had three separate measles outbreaks in 2013 in the northern part of the country (Lai Chau, Lao Cai and Ha Giang provinces) after very low measles incidence in 2012. Each outbreak was quickly detected and thoroughly investigated.
- Cambodia had three incidents with measles cases in the second half of 2016, after being verified in March 2015 to have interrupted endemic measles transmission since November 2011. Each case was quickly reported to the national immunization programme and a thorough investigation, including aggressive contact tracing and assessment of vaccination coverage, was carried out for each incident immediately after notification.

### **Strategy 6.4**

#### **Conduct timely outbreak response immunization targeting appropriate geographical areas and birth cohorts**

##### **Issue or challenge**

- Outbreak response immunization was not carried out promptly or with appropriate target population size in several countries during the recent measles resurgence or outbreaks.

##### **Strategic targets**

- Detection and vaccination of previously unvaccinated persons initiated immediately after an outbreak is suspected.
- Planning and preparation in place to ensure a non-selective SIA, targeting appropriate geographical areas and birth cohorts, can be carried out within two weeks of an outbreak being confirmed.<sup>22</sup>

22. Refer to *Measles Elimination Field Guide* (2013).

### Proposed activities

- a. Ensure that all household, community and health-care contacts<sup>23</sup> without history of vaccination or illness are detected and provided with MRCV.
- b. Conduct a district-wide or province-wide non-selective MRCV SIAs when the above activity: i) does not stop transmission; or ii) multiple communities are affected by outbreaks.
- c. Consider supplementary vaccine doses for unvaccinated children 6 months and older who are not yet age-eligible for the first dose of MCV1 in the national immunization programme.<sup>24</sup>
- d. Consider supplementary vaccine doses for post-partum mothers, their families and caregivers for newborns to protect infants aged < 6 months and to reduce case fatality during outbreaks.

### Successful experiences

- The Lao People's Democratic Republic carried out district-wide outbreak response immunization activities immediately after outbreaks were confirmed (in Xaychamphone District of Bolikhamxay Province in July 2015 and in Xamtay District of Houaphanph Province in October 2015).
- Solomon Islands promptly mobilized international resources and conducted a nationwide, non-selective wide-age-range MRCV SIA targeting those aged 6 months to 30 years in September–December 2014 while a measles outbreak detected in July 2014 was spreading across the country.
- Cambodia carried out a subnational, non-selective MRCV SIA targeting those aged 9–59 months in March 2016 after detection of two confirmed measles cases followed by the assessment of vaccination coverage as part of outbreak investigation in January–February 2016.

## Strategy 6.5

### Ensure all health facilities provide appropriate clinical management of suspected measles, rubella and CRS cases

#### Issue or challenge

- High case fatality rates were reported in several countries.

#### Strategic target

- Case management protocols for measles, rubella and CRS are available at all health facilities.

23. Contacts are defined as all persons living in a household or other close quarters with the case during the infectious period, five days before to five days after the onset of the rash. Refer to *Field Guidelines for Measles Elimination* (2004).

24. See Recommendations of the 24th Meeting of the Technical Advisory Group on Immunization and Vaccine-Preventable Disease (Appendix 4).

**Proposed activities**

- a. Develop national case management protocols for measles, rubella and CRS.
- b. Ensure all health facilities are provided with the national case management protocols.
- c. Conduct regular training for national, provincial and district staff to ensure all health staff are familiar with the case management protocols.

**Strategy 6.6****Prevent nosocomial transmission****Issue or challenge**

- Measles transmissions and outbreaks were amplified in hospitals and by health staff in several countries during the recent measles resurgence and outbreaks.

**Strategic target**

- Nosocomial transmission of measles and rubella prevented during outbreaks.

**Proposed activities**

- a. Ensure all health workers are immune to measles and rubella (for example, vaccination of health workers).
- b. Develop national guidelines for preventing the nosocomial transmission of measles and rubella viruses, including infection from CRS cases. Guidelines should include appropriate triage, patient placement and airborne isolation precautions.
- c. Ensure all health facilities are provided with the national guidelines.
- d. Conduct regular training for national, provincial and district staff to ensure all health staff are familiar with the guidelines.
- e. Ensure that all health care associated cases are promptly investigated, including contact tracing with appropriate post-exposure measles prophylaxis to exposed patients, family members and health workers.
- f. Develop public messages on the isolation of suspected cases and care of uncomplicated cases at home.
- g. Furlough all health-care workers who have suspected or confirmed measles or rubella, from the first day of symptoms until four days after rash onset. Furlough all susceptible health-care workers who have been exposed to a suspected or confirmed measles or rubella case, from five days until 21 days following exposure, regardless of symptoms and post-exposure prophylaxis.

## Strategic area 7

### Partnership, advocacy, IEC and social mobilization

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#### Strategy 7.1

#### Revitalize or establish immunization partnerships for measles and rubella elimination at both national and regional levels

##### Issue or challenge

- Partnerships for regional measles and rubella elimination are not sufficiently strong.

##### Strategic target

- A regional partnership for promoting measles and rubella elimination activities established in the Western Pacific.

##### Proposed activities

- a. Revitalize functions of the Inter-Agency Coordination Committee (ICC) for measles and rubella elimination through regularly reviewing progress and challenges in measles and rubella elimination and discussing interagency collaboration for measles and rubella elimination.
- b. Establish or enhance inter-ministerial coordination and collaboration and public-private partnership (PPP) for promoting measles-rubella vaccination for school-entry vaccination history checks and immunization requirements, vaccination for student at entry or at school, and vaccination for high-risk groups, for example, factory workers, transportation and hospitality workers, military personnel, police, and others living or working in communal settings.

##### Successful experience

- The Measles and Rubella Initiative (MRI) is an example of an effective cooperative partnership led by the American Red Cross, the United States Centers for Disease Control and Prevention, the United Nations Children's Fund (UNICEF), the United Nations Foundation and WHO. MRI aims to reach measles and rubella elimination goals of the *Global Vaccine Action Plan* by supporting countries to raise coverage of MRCV; fund, plan, implement and monitor quality SIAs; investigate outbreaks and provide technical and financial support for effective outbreak response; propose and participate in solutions to strengthen immunization delivery; and support the global measles and rubella laboratory network.

## Strategy 7.2

### Enhance advocacy activities by RVC, SRVC and NVCs for measles and rubella elimination

#### Issue or challenge

- While the Regional Verification Commission (RVC), established in 2012, and the Subregional Verification Committee (SRVC) and national verification committees (NVCs) were established in 2012 and 2013–2014, respectively, “advocacy” as one of their core functions and terms of reference has not been fully implemented.

#### Strategic targets

- Each NVC develops and conducts advocacy activities for promoting measles and rubella elimination and reports its activities in the annual NVC report.
- RVC coordinates with WHO in developing a regional partnership for promoting measles and rubella elimination activities.

#### Proposed activities

- a. Ensure National Immunization Technical Advisory Groups (NITAG) and NVCs regularly review and discuss progress and challenges in measles and rubella elimination and provide technical advice to the Ministry of Health.
- b. Strengthen the advocacy functions of RVC, SRVC and NVCs in raising awareness of and commitment to measles and rubella elimination, targeting high-ranking health officials, health professionals, partners and political leaders through multiple channels, such as national health conferences, scientific seminars, media and personal networks.
- c. Conduct periodic national reviews on progress towards measles and rubella elimination in countries with endemic or prolonged transmission in particular with participation of RVC, WHO and other international partners.
- d. Establish or enhance inter-ministerial coordination and collaboration and public–private partnership (PPP) for advocating measles and rubella elimination and CRS prevention.

#### Successful experience

- In the WHO European Region, joint visits were carried out by WHO, RVC and partners to measles-endemic countries.

### **Strategy 7.3**

#### **Develop and implement IEC strategies for increasing knowledge of the general public about measles, rubella, CRS and importance of their prevention by vaccination**

##### **Issue or challenge**

- The general public and minority groups in several countries still have very limited knowledge about measles, rubella, CRS and importance of their prevention by vaccination.

##### **Strategic target**

- A communications strategy, and information, education and communications (IEC) materials and programmes, developed in local language with consideration of country-specific situation.

##### **Proposed activity**

- a. Establish partnership with social media and nongovernmental organizations and disseminate knowledge and awareness on measles, rubella, CRS and importance of their prevention by vaccination through social media, for example radio, TV and social media networks.

### **Strategy 7.4**

#### **Mobilize local governments, the private sector, societies, communities and families regularly for promoting measles and rubella elimination activities (including defaulters, MR vaccination and case detection and reporting)**

##### **Issue or challenge**

- There are no regular activities in several countries to mobilize local governments, the private sector, societies, communities and families for promotion of measles and rubella elimination activities.

##### **Strategic target**

- National Immunization Week carried out with involvement of local governments, the private sector, societies, communities and families for promotion of measles and rubella elimination activities.

##### **Proposed activities**

- a. Actively involve and coordinate with local governments, the private sector, societies, communities and families in organizing the National Immunization Week (NIW), in which the measles and rubella elimination and CRS prevention is ensured to be part of the regular agenda every year.

- b. In countries with large populations (for example, more than 50 million population), establish a provincial Measles Elimination Coordinating Committee to provide the strategic and technical guidance to the provincial health department in developing the provincial plan, as well as assistance in its implementation.

**Successful experience**

- The Ministry of Health, Labour and Welfare in Japan encouraged and supported each of 47 prefecture governments to establish prefecture measles elimination committees and develop prefecture-specific plans for implementation of strategies for vaccination, surveillance, outbreak response, multisectoral coordination and social mobilization in 2008, a year after a nationwide measles outbreak.

## Strategic area 8

### Progress monitoring and verification of elimination

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#### Strategy 8.1

##### Update and finalize the Guidelines for Verification to include rubella

###### Issue or challenge

- The Western Pacific Region has not yet finalized criteria and lines of evidence for rubella elimination verification.

###### Strategic targets

- Criteria and lines of evidence for verification of rubella elimination finalized in 2017.
- Progress towards and verification of rubella elimination documented by NVCs and verification process started by RVC in 2017.

###### Proposed activities

- a. RVC and WHO update the current regional guidelines on verification of measles elimination adding criteria and lines of evidence for rubella elimination.
- b. RVC and WHO support NVCs in developing an annual NVC report documenting progress towards and status of rubella elimination, using updated regional guidelines on verification of measles elimination with additional criteria and lines of evidence for rubella elimination.

#### Strategy 8.2

##### Ensure that RVC and NVCs prepare strategic recommendations for further progress towards elimination in each country and NVC to actively encourage the Ministry of Health to implement RVC's recommendations

###### Issue or challenge

- RVC recommendations to NVCs have not yet been fully reflected in the national measles and rubella elimination programme in several countries.

###### Strategic targets

- Countries with resurgence in 2013–2016 or with ongoing transmission should be provided with strategic recommendations prepared by NVC with endorsement and input from RVC.
- RVC recommendations to NVCs should be reflected in a timely manner in implementation of measles and rubella elimination activities.

**Proposed activity**

- a. Periodically conduct RVC member advocacy visits and/or national reviews of progress towards measles and rubella elimination in countries with endemic or prolonged transmission, in particular with participation of NVC, RVC, WHO and other international partners, and prepare strategic recommendations for further progress towards elimination for the government.

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# APPENDIX 1

## WPR/RC54.R3

### Expanded Programme on Immunization: Measles and Hepatitis B

#### The Regional Committee,

Noting the historic achievement of the Region in becoming the second WHO region to be declared poliomyelitis-free;

Recognizing the positive impact of poliomyelitis eradication in the Western Pacific Region on the Expanded Programme on Immunization (EPI) and the wider health sector;

Mindful of the high burden of disease, disability, and deaths from vaccine-preventable diseases, especially measles and hepatitis B;

Aware that this burden could be very significantly reduced by use of available vaccines that are safe, effective and inexpensive;

Noting that in some countries there is a lack of laboratory capacity for confirmation of measles cases;

Noting resolution WHA56.20 on global reduction of measles mortality;

Further noting that 95% population immunity is essential to achieve measles elimination;

Recognizing that some countries have made significant progress towards achieving this level of immunity;

Noting with appreciation the significant contribution to hepatitis B control in the Region by the Global Alliance on Vaccines and Immunization and other partners;

1. DECIDES that, in the Western Pacific Region, measles elimination and hepatitis B control should be the two new pillars to strengthen the EPI;
2. CONFIRMS that measles elimination should be a regional goal and establishment of a target date should be made at the earliest opportunity and should be based on an annual review of progress;
3. FURTHER CONFIRMS that the objective of hepatitis B control programmes should be HBsAg prevalence of less than 1% in five-year-olds born after hepatitis B immunization started;
4. ENDORSES the Western Pacific Regional Plan of Action for Measles Elimination and the Western Pacific Regional Plan to Improve Hepatitis B Control through Immunization;

5. URGES Member States:
  - (1) to develop or strengthen national plans for measles elimination and hepatitis B control as part of overall plans for immunization services;
  - (2) to use measles elimination and hepatitis B control strategies to strengthen EPI and other public health programmes, such as prevention of congenital rubella syndrome;
  - (3) to offer, in principle, all children two doses of measles vaccine, taking into account local situations, so that the 95% population immunity of each birth cohort can be achieved and maintained in every district;
  - (4) to develop or strengthen measles surveillance systems and laboratory confirmation of cases;
  - (5) to ensure that at least 80% (ideally 95%) of each birth cohort in every district receives three doses of hepatitis B vaccine by the age of 12 months, except in countries where a high-risk approach (i.e. immunization for babies of carrier mothers) has been shown to be effective;
  - (6) to improve the quality of routinely reported immunization coverage data and to monitor both immunization (including timely scheduled birth dose of hepatitis B vaccine, i.e. within 24 hours of birth) and disease data at district level in order to improve programme management;
  
6. REQUESTS the Regional Director:
  - (1) to further strengthen technical cooperation with Member States, in particular the improvement of immunization coverage and surveillance, including strengthening laboratory capacity in the Region, in order to achieve measles elimination and to improve hepatitis B control;
  - (2) to seek the additional resources required to support these activities;
  - (3) to report on progress regularly to the Regional Committee and to propose a target date for regional measles elimination in due course.

10 September 2003

## APPENDIX 2

### WPR/RC56.R8

### Measles Elimination, Hepatitis B Control and Poliomyelitis Eradication

#### The Regional Committee,

Noting resolution WPR/RC54.R3 to use measles elimination and hepatitis B control strategies as a means to strengthen the Expanded Programme on Immunization (EPI) and other public health programmes;

Recognizing the positive impact of poliomyelitis eradication in the Western Pacific Region on EPI and the wider health sector, as well as the serious challenges to the maintenance of polio-free status;

Mindful of the high burden of disease, disability and deaths from vaccine-preventable diseases, especially measles and hepatitis B;

Aware that this burden could be very significantly reduced by the use of available vaccines that are safe, effective and inexpensive;

Recognizing financial and operational challenges to measles elimination and hepatitis B control in some countries and areas as recognized in the 15th Technical Advisory Group recommendations,

1. DECIDES that the Region should aim by 2012:
  - (1) to eliminate measles;
  - (2) to reduce the seroprevalence of HbsAg to less than 2% in five year-old children as an interim milestone towards the final regional goal of less than 1% HbsAg;
2. URGES Member States:
  - (1) to develop or strengthen national plans for measles elimination and hepatitis B control, as part of comprehensive multi-year plans for immunization services to enable achievement of the twin regional goals;
  - (2) to regularly monitor the implementation of activities under measles elimination and hepatitis B control plans;
  - (3) to maintain polio-free status by sustaining high-quality acute flaccid paralysis surveillance and high immunization coverage of polio vaccines;

3. REQUESTS the Regional Director:
  - (1) to further strengthen technical cooperation with Member States and seek the additional resources required to support country and area activities to achieve the measles elimination and hepatitis B control goals;
  - (2) to report regularly to the Regional Committee on progress towards measles elimination and hepatitis B control.

23 September 2005

## APPENDIX 3

### WPR/RC63.R5

#### Elimination of Measles and Acceleration of Rubella Control

##### The Regional Committee,

Recalling resolutions WPR/RC54.R3 that called for measles elimination, WPR/RC56.R8 that established the target year of 2012, and WPR/RC61.R7 that reaffirmed the 2012 measles elimination goal and called for acceleration of rubella control;

Recalling the May 2012 resolution WHA65.17 endorsing the Global Vaccine Action Plan that calls for achieving and sustaining high and equitable vaccine coverage;

Acknowledging the dramatic decline in the number of measles cases from almost 146 000 in 2008 to 21 000 (an 86% reduction) in 2011; and that measles transmission continues in few countries in 2012 and continues to decrease;

Recognizing the Region is now on the verge of eliminating measles and could be the second Region to achieve measles elimination;

Noting the Western Pacific Regional Verification Commission on Measles Elimination has been established, and the verification mechanism has been elaborated in consultation with Member States;

Aware that three years will be required for national and regional verification from the last endemic measles case, to demonstrate the achievement is sustainable;

Mindful of various opportunities to synergize measles elimination and rubella control activities,

1. REAFFIRMS its commitment to eliminate measles and accelerate rubella control in the Western Pacific Region;
2. URGES Member States:
  - (1) to interrupt all residual endemic measles virus transmission as rapidly as possible, through ensuring high population immunity with measles vaccine;
  - (2) to implement effective immunization strategies to identify and reach all vulnerable underserved communities in both rural and urban settings;
  - (3) to enhance systems and capacity for preparedness, rapid detection and response to measles outbreaks whether caused by an endemic or

imported virus, to prevent the spread and re-establishment of measles virus transmission;

- (4) to improve sensitivity and performance of epidemiological surveillance and laboratory capacity to identify the source of infection, and demonstrate the absence of endemic transmission, for eventual verification;
- (5) to establish national verification committees that develop regular progress reports for submission to the Regional Verification Commission;
- (6) to further accelerate control of rubella and prevention of congenital rubella syndrome through integration of measles and rubella immunization and surveillance activities;

**3. REQUESTS the Regional Director:**

- (1) to continue supporting Member States in their efforts to eliminate measles;
- (2) to continue advocating for measles elimination, seek additional resources to achieve and sustain measles elimination and accelerate rubella control;
- (3) to enhance international collaboration in measles elimination across regions and national borders;
- (4) to report progress to the Regional Committee.

27 September 2012

## APPENDIX 4

### Recommendations of the Technical Advisory Group on Immunization and Vaccine-Preventable Disease, the 24th Meeting, 9–12 June 2015, Manila, Philippines

#### Measles and Rubella Elimination

1. TAG recommends that countries achieve and maintain high coverage with the timely administration of two doses of measles- and-rubella-containing vaccine in accordance with the national immunization schedule. Countries in the Region that have not yet introduced the second routine dose of measles- and-rubella-containing vaccine (MRCV) should take steps to improve coverage of MRCV1 and introduce MRCV2. School enrolment for all ages (primary, secondary and post-secondary) should be used as an opportunity to check full vaccination status and administer missed doses.
2. Countries experiencing endemic measles virus transmission or measles outbreaks following importation(s) should recommit to implement actions recommended by TAG in its 23rd meeting in June 2014, specifically to:
  - (a) conduct detailed analyses of the coverage data and the epidemiology of measles cases and outbreaks including genotyping data on chains of transmission;
  - (b) update their national measles-rubella elimination plans and strategies;
  - (c) develop or update subnational plans and strategies (endemic countries with large population);
  - (d) update and actively implement their measles outbreak response plans including the early notification of nearby countries and areas about measles virus transmission;
  - (e) enhance surveillance activities with aggressive case detection and thorough outbreak investigations as well as appropriate case management and vaccination of susceptible contacts;
  - (f) identify immunity gaps by geographic area, birth cohort and risk group;
  - (g) fill immunity gaps (e.g. selective immunization activities or smaller-scale, such as regional or province-wide, supplemental immunization activities [SIAs] targeting appropriate age groups; or more frequent follow-up SIAs targeting birth cohorts born after the last SIA in specific regions or provinces), based on country-level data; in outbreak settings, children 6 months of age and older should be vaccinated. Children who receive a dose of measles-rubella vaccine before the recommended age specified in the national immunization schedule should receive two doses according to the national schedule with at least 30 days between doses. Measles-

rubella combination vaccines should be used for all routine and supplementary immunizations activities rather than using single antigen measles or single antigen rubella vaccines;

- (h) conduct high-quality SIAs with > 95% coverage based on thorough analysis of and lessons learnt from the past SIAs; analysis should include identification of the susceptible population(s), the geographic areas to be covered and specific high-risk groups; post-campaign coverage surveys should be conducted;
  - (i) implement infection control measures and health-care facility practices to prevent nosocomial transmission of measles and rubella including vaccination of health workers; and
  - (j) encourage full vaccination prior to international travel for all travellers and especially for those who travel to and from measles-endemic or measles-infected countries and areas.
3. WHO should continue to work with other international partners in supporting countries to plan and conduct these actions.
  4. WHO should update the current Western Pacific Regional Plan of Action for Measles Elimination (2003) with inclusion of the following components:
    - (a) guidance on conducting risk assessments and outbreak response immunization activities followed by implementation of targeted strategies for preventing and interrupting measles virus transmission among young infants, adolescents and adults by identifying risk factors/characteristics of affected people (e.g. health-care workers, university students, military personnel, migrants); and
    - (b) strategies for rubella elimination.
  5. TAG endorses the report and recommendations of the Fourth Annual Meeting of the Regional Verification Commission (RVC) for Measles Elimination in the Western Pacific held in March 2015. TAG encourages expanding the terms of reference of the RVC to include rubella elimination. WHO should update the current Guidelines on Verification of Measles Elimination (2013) with inclusion of components for verification of rubella elimination.
  6. Now that all countries and areas have introduced (or will introduce during 2015–2016) rubella-containing vaccine into their routine immunization programmes and the Western Pacific Region has committed to eliminate rubella, TAG recommends:
    - (a) establishment of a regional rubella elimination target date of 2020; and
    - (b) that the sixty-seventh session of the Regional Committee for the Western Pacific in 2016 consider setting a target year for rubella elimination as an agenda item.
  7. WHO should continue to work with other international partners in supporting countries to strengthen rubella and CRS surveillance, including virological investigation.

## APPENDIX 5

### **Recommendations of the Technical Advisory Group on Immunization and Vaccine-Preventable Disease, the 25th Meeting, 26–29 July 2016, Manila, Philippines**

#### **Measles and Rubella Elimination**

##### **Recommendations for Member States**

1. The TAG encourages Member States to continue to make efforts to increase coverage achieved with routine and supplemental administration of measles–rubella (MR) vaccine.
2. The TAG reaffirms its 2015 recommendation to establish a regional rubella elimination target date of 2020.
3. The TAG encourages countries to update or develop national strategies and plans of action for measles and rubella elimination. The draft Measles and Rubella Elimination in the Western Pacific – Regional Strategy and Plan of Action may serve as a valuable resource to Member States.
4. The TAG encourages countries to establish and maintain a platform to provide immunizations in the second year of life as an opportunity to reach all children, including those who are hard to reach, with MR and other scheduled vaccines and for catch-up immunizations for under-immunized children, as needed. To prevent measles virus transmission among preschool-aged children who are at highest risk of dying from measles, the second routine dose should be given in the second year of life.
5. The TAG encourages countries and areas to monitor and track coverage for the second dose of MR, to document the drop-out rate between the first and second doses of MR, and to work to reduce the drop-out rate. The WHO Regional Office for the Western Pacific should inventory which countries and areas have programme policy restrictions that limit vaccinations offered after 12 months of age and should work with countries and areas to remove these barriers to vaccination.
6. The TAG reiterates its 2014 recommendation that for countries experiencing measles outbreaks, supplementary vaccine doses should be considered for unvaccinated children aged 6 months and older who are not yet age eligible for the first dose of measles-containing vaccine (MCV1) in the national immunization programme and

who are at high risk of exposure to the measles virus, such as in outbreak settings or expected travel to measles-affected areas. Children who receive supplementary measles vaccine doses prior to the country's recommended age for MCV1 should continue to receive the two doses of MR according to the national immunization schedule. School entry should be used as an opportunity to ensure that all children have two documented doses of MR prior to school entry.

7. TAG encourages all countries to implement school-based programmes to check immunization records to maximize immunization coverage through catch-up immunization as needed. China and the Republic of Korea have successfully implemented the strategy. The recently published experience of China in the use of school-based checks of immunization records should be distributed to all countries by the Regional Office for the Western Pacific as an example of what can be achieved.
8. Appropriate infection control measures and health-care facility practices should be implemented to prevent transmission of measles and rubella in health-care settings, especially in hospitals. These plans should include strategies to ensure that all health workers are immune to measles and rubella.

### **Recommendations for WHO Secretariat**

1. By the end 2016, WHO should finalize the draft Measles and Rubella Elimination in the Western Pacific – Regional Strategy and Plan of Action through further consultation with TAG, national immunization programmes of Member States and partners.
2. WHO should submit the final Measles and Rubella Elimination in the Western Pacific – Regional Strategy and Plan of Action to the sixty-eighth session of WHO Regional Committee for the Western Pacific in 2017 for review and endorsement.
3. TAG requests WHO to consult with Member States for setting the target year for regional rubella elimination.
4. WHO should complete revisions of the Guidelines on Verification of Measles Elimination in the Western Pacific Region (2013) through further consultation with the Regional Verification Commission for Measles Elimination in the Western Pacific (RVC), Subregional Committee for the Verification of Measles Elimination in Pacific island countries and areas (SRVC) and national verification committees (NVCs) to include monitoring progress of rubella elimination, along with measles elimination in each country and area.

# APPENDIX 6

## Proposed Framework for National Plan of Action for Measles and Rubella Elimination

### Strategic area 1

#### Overall planning and immunization system

Unresolved issues or emerging challenges	Strategy	Strategic targets
<ul style="list-style-type: none"> <li>Several countries with reported high coverage of MCV-1, MCV-2 and MCV-SIAs at the national level were affected by large-scale measles outbreaks, or re-establishment of endemic measles virus transmission.</li> <li>Several countries experienced changing epidemiology in the age distribution of measles cases in recent measles outbreaks (e.g. increased incidence among infants too young to be vaccinated, as well as among adolescents and adults not targeted by the current strategies).</li> <li>Several countries have not yet developed a national strategy and plan of action for rubella elimination although they introduced RCV into the national immunization programme and the WHO's Regional Committee for the Western Pacific determined regional rubella elimination as one of regional immunization goals for the Western Pacific.</li> <li>Similar to the situation with measles, several countries experienced changing epidemiology in the age distribution of rubella cases. Age of infection shifting towards older age groups could be a particular concern because of higher risk of CRS.</li> </ul>	<p>1.1 Update the National Strategies and Plan of Action for Measles and Rubella Elimination</p>	<ul style="list-style-type: none"> <li>Updated National Strategies and Plan of Action for Measles and Rubella Elimination</li> </ul>
<ul style="list-style-type: none"> <li>Measles epidemiology (e.g. age distribution of measles cases) has varied within countries in recent resurgence.</li> </ul>	<p>1.2 Develop Subnational (e.g. Provincial or Regional) Plans and Strategies for Measles and Rubella Elimination in countries with large populations</p>	<ul style="list-style-type: none"> <li>Subnational Plan and Strategies developed in each second level administrative area with full consideration of area-specific situations</li> </ul>
<ul style="list-style-type: none"> <li>Insufficient or weak supply chain system and practices were observed and reported in several countries by external monitors during recent mass vaccination campaigns and/or by international reviewers during recent national EPI reviews.</li> </ul>	<p>1.3 Establish and sustain supply chain system and practices strong enough for measles and rubella elimination activities</p>	<ul style="list-style-type: none"> <li>No stock-outs, and in-time and proper distribution of vaccines and all ancillaries at all levels for both routine immunization programme and mass vaccination campaigns</li> </ul>

Activities	Annual Plan of Action 2018–2025							
	2018	2019	2020	2021	2022	2023	2024	2025
<ul style="list-style-type: none"> <li>a. Conduct thorough analysis on causes of re-establishment of endemic measles virus transmission or large-scale measles outbreaks in 2013–2016</li> <li>b. Conduct thorough analysis of recent rubella outbreaks and identify risks factors</li> <li>c. Identify people and groups at increased risk for acquiring measles, through careful characterization of unvaccinated persons and barriers to vaccination</li> <li>d. Organize national consultations with partners if appropriate to update national plans and strategies for measles and rubella elimination</li> </ul>								
<ul style="list-style-type: none"> <li>a. Conduct thorough analysis on causes for resurgence of endemic measles virus transmission or large-scale measles outbreaks in 2013–2016, region by region or province by province for countries with a large population)</li> <li>b. Identify people and groups at increased risk for acquiring measles, characteristics of unvaccinated persons and barriers to vaccination</li> <li>c. Organize national consultations and training with partners if appropriate for developing subnational plan and strategies for measles and rubella elimination in each administrative area with &gt; 1 million population</li> </ul>								
<ul style="list-style-type: none"> <li>a. Ensure regular assessments of cold chain inventory, functionality and needs at each level</li> <li>b. Ensure timely and accurate forecasting</li> <li>c. Secure adequate financial and operational resources for vaccine procurement, repair, maintenance or replacement of cold chain infrastructure, and timely distribution of vaccines and ancillaries</li> <li>d. Ensure timely procurement of needed cold chain supplies and equipment and adequate maintenance and repair of cold chain equipment at all levels</li> <li>e. Ensure timely procurement of sufficient vaccines</li> <li>f. Proactively conduct monitoring and communication on vaccine delivery throughout the supply chain to prevent vaccine stock-outs at all levels</li> <li>g. Ensure a mechanism is in place to provide and document catch-up vaccination if coverage is interrupted due to stock-out</li> <li>h. Periodically conduct effective vaccine management assessments and update implementation plans based on assessment findings</li> </ul>								

## Strategic area 1 (continued)

### Progress monitoring and verification of elimination

Unresolved issues or emerging challenges	Strategy	Strategic targets
<ul style="list-style-type: none"> <li>Inappropriate practices for vaccine, injection (e.g. subcutaneous MRCV administered incorrectly as an intramuscular injection), immunization safety and waste management, and false contraindications to vaccination were observed and reported by external monitors during previous mass vaccination campaigns in several countries.</li> <li>Insufficient preparedness for adverse events following immunization (AEFIs) and weak AEFI monitoring was also observed and reported by external monitors during previous mass vaccination campaigns in several countries.</li> </ul>	<p>1.4 Further improve immunization practices</p>	<ul style="list-style-type: none"> <li>Needle stick injuries avoided at all health care facilities</li> <li>No AEFIs due to immunization-related error in the national immunization programme</li> <li>All serious AEFIs investigated thoroughly and managed properly</li> <li>Immunization-related medical waste properly managed at all health care facilities and communities</li> <li>Eligible children are not denied vaccination in routine and mass vaccination campaigns due to false contraindications</li> </ul>

Activities	Annual Plan of Action 2018–2025							
	2018	2019	2020	2021	2022	2023	2024	2025
<ul style="list-style-type: none"> <li>a. Regularly conduct training for the staff at all levels on safe injection practices, safe waste management, and correct eligibility criteria and contraindications for vaccination</li> <li>b. Regularly conduct training for the staff at all levels on functional surveillance and response to adverse events following immunization (AEFIs)</li> </ul>								

## Strategic area 2

### Immunization

Unresolved issues or emerging challenges	Strategy	Strategic targets
<ul style="list-style-type: none"> <li>Some countries give a first dose of RCV with MCV2, the coverage of which is much lower than the coverage of MCV1.</li> <li>In several countries, children aged 2–5 years experienced increased measles virus transmission.</li> </ul>	2.1 Optimize MCV1, MCV2 and RCV schedules for measles and rubella elimination	<ul style="list-style-type: none"> <li>All countries and areas give two doses of MRCV in the national immunization programme</li> <li>MRCV2 given during the second year of life with high coverage in countries where children aged 2–5 years were affected during the recent measles resurgence or outbreaks</li> </ul>
<ul style="list-style-type: none"> <li>Children aged less than 2 years were affected by increased measles virus transmission in several countries.</li> <li>Children born after the previous MCV-SIA experienced increased measles virus transmission in several countries during the recent measles resurgence or outbreaks.</li> </ul>	2.2 Establish and maintain high-enough population immunity to achieve and sustain interruption of measles and rubella virus transmission among children <24 months old by an intensified routine immunization programme	<ul style="list-style-type: none"> <li>All children provided with both MRCV1 and MRCV2 before their second birthday</li> </ul>
<ul style="list-style-type: none"> <li>Children aged 2–5 years experienced increased measles virus transmission in several countries during the recent measles resurgence or outbreaks.</li> </ul>	2.3 Establish and maintain high-enough population immunity to achieve and sustain interruption of measles and rubella virus transmission among pre-school-age children by catch-up vaccination at entry to child care service and/or by periodic follow-up SIA	<ul style="list-style-type: none"> <li>All unvaccinated children detected and provided with an opportunity for full vaccination status before entry to day care/pre-school/kindergarten</li> </ul>
<ul style="list-style-type: none"> <li>School aged children still experienced measles virus transmission in several countries during the recent measles resurgence or outbreaks.</li> </ul>	2.4 Establish and maintain high-enough population immunity to achieve and sustain interruption of measles and rubella virus transmission among school children	<ul style="list-style-type: none"> <li>Neither measles nor rubella outbreak occurs among school children or in any school</li> </ul>

Activities	Annual Plan of Action 2018–2025							
	2018	2019	2020	2021	2022	2023	2024	2025
<ul style="list-style-type: none"> <li>a. Change the national immunization schedule to: <ul style="list-style-type: none"> <li>– give the first dose of RCV with the first dose of MCV as MR vaccine or MMR vaccine at 9 months; and</li> <li>– give MCV2 before the second birthday i.e. at age 15–18 month</li> </ul> </li> <li>b. Improve coverage of MRCV1 and introduce MRCV2 (for countries that have not yet introduced MRCV2, if &gt;80% coverage with MRCV1)</li> </ul>								
<ul style="list-style-type: none"> <li>a. Ensure all infants are provided with the national vaccination card</li> <li>b. Ensure all vaccinations are registered in immunization registry at the time of each administration</li> <li>c. Ensure all children under 2 years of age are monitored on vaccination history by vaccination card and/or vaccination record book</li> <li>d. Ensure all children are given opportunities for receiving two doses of MRCV by their second birthday by the routine vaccination programme or high-risk-group SIA, or during the National Immunization Week or through enhanced RED / REC strategies</li> <li>e. Conduct complementary activities to verify high population immunity through cross-sectional serological surveys, such as testing convenience samples (e.g. blood bank samples) or conducting representative surveys for the whole country or high risk geographical areas if feasible</li> </ul>								
<ul style="list-style-type: none"> <li>a. Promote vaccination history check at entry to day care/pre-school/kindergarten</li> <li>b. Encourage requirements for vaccination before entry to day care/pre-school/kindergarten</li> <li>c. Conduct periodic follow-up SIAs every 3–4 years unless Strategy 2.2 and Activity d) are fully implemented</li> </ul>								
<ul style="list-style-type: none"> <li>a. Promote vaccination history checks at entry to all schools (from elementary to college)</li> <li>b. Encourage school-entry requirement of vaccination for all schools (from elementary to college)</li> <li>c. Develop and conduct school-based vaccination programmes for non-fully vaccinated students at entry to any school</li> <li>d. Periodically conduct selective MRCV-SIA for school children that are non-fully vaccinated (e.g. during national immunization week)</li> <li>e. Conduct non-selective MRCV-SIAs when an outbreak is detected among school children</li> </ul>								

## Strategic area 2 (continued)

### Immunization

Unresolved issues or emerging challenges	Strategy	Strategic targets
<ul style="list-style-type: none"> <li>Adults experienced measles virus transmission in several countries during the recent measles resurgence or outbreaks.</li> <li>Recently, large-scale rubella outbreaks occurred among young adults in workplaces in several countries.</li> </ul>	<p>2.5 Prevent measles and rubella virus transmission among young adults and in workplaces</p>	<ul style="list-style-type: none"> <li>Measles and rubella outbreaks prevented, or contained at small scale, among young adults or in any workplace or confined setting (e.g. dormitories, factories)</li> </ul>
<ul style="list-style-type: none"> <li>Specific communities or groups in some countries have continued to be affected by outbreaks and have triggered large-scale measles outbreaks.</li> </ul>	<p>2.6 Prevent measles and rubella outbreaks in high-risk populations, communities or groups</p>	<ul style="list-style-type: none"> <li>High-risk communities or groups identified and provided with opportunities for vaccination</li> <li>Measles and rubella outbreaks prevented in high-risk communities or groups</li> </ul>

Activities	Annual Plan of Action 2018–2025							
	2018	2019	2020	2021	2022	2023	2024	2025
<p>a. Engage relevant sectors (e.g. education, occupational health, military, regulatory authorities for labour and social security, transportation, etc.) in collaborative activities for prevention of measles and rubella outbreaks among young adults or in any workplace or confined setting</p> <p>b. Promote vaccination with MRCV for targeted adult groups living or working in communal settings (e.g. students, health workers, factory workers, transportation and hospitality workers, military personnel, police and others) at entry to colleges, universities and workplaces</p> <p>c. Conduct selective MRCV-SIA for high risk adult groups, e.g. migrants to urban slums, seasonal workers</p> <p>d. Conduct one-time non-selective Speed-up MRCV-SIA<sup>1</sup> for countries with small populations</p> <p>e. Incorporate mass MR vaccination into a wide-age-range (e.g. 15–44 years) TT-SIA for women of reproductive age conducted for MNTE excluding pregnant women</p> <p>f. Promote immunization requirements before international travel from / to endemic countries</p>								
<p>a. Develop and conduct special communication and immunization strategies tailored for high-risk groups (e.g. ethnic minority groups, migrants, religious objectors, nomads, remote areas), identified by analysis of data from surveillance and outbreak investigations</p> <p>b. Proactively take corrective actions to fill immunity gaps (e.g. selective immunization activities or smaller-scale, such as regional or province-wide SIA targeting appropriate age groups; or more frequent follow-up SIAs targeting birth cohorts born after the last SIA in specific regions or provinces), based on country-level data. In outbreak settings, children 6 months of age and older should be vaccinated</p> <p>c. Promote development of microplans in every district for both routine and supplemental immunization service delivery (following the Reaching Every District strategy [WHO, 2009. WHO/IVB/09.11])</p>								

1. A speed-up MRCV-SIA is a 1-time campaign that targets older children, adolescents and adults (the age group of males and females to be vaccinated depends on which year the vaccine is introduced, the coverage of follow-up campaigns, epidemiology, and fertility rates in the country) (WHO. Rubella Vaccines: WHO position paper. Wkly Epidemiol Rec. 2011;86:301-316).

## Strategic area 3

### Progress monitoring and verification of elimination

Unresolved issues or emerging challenges	Strategy	Strategic targets
<b>3. EPIDEMIOLOGIC SURVEILLANCE</b>		
<ul style="list-style-type: none"> <li>Rubella is not a reportable condition in some countries and areas.</li> <li>Some countries still use a suspected case definition for measles only, which is insufficiently sensitive for rubella.</li> </ul>	<p>3.1 Establish nationwide case-based integrated AFR surveillance for measles and rubella</p>	<ul style="list-style-type: none"> <li>Surveillance systems are designed to detect and report all cases of acute rash illness and fever that could be measles or rubella</li> <li>Samples are collected and tested for measles and rubella using an integrated strategy</li> </ul>
<ul style="list-style-type: none"> <li>There are still many provinces and districts with low sensitivity in surveillance (low "reporting rate at second administrative level").</li> </ul>	<p>3.2 Ensure all suspected measles and rubella cases are detected and reported by all health facilities</p>	<ul style="list-style-type: none"> <li>Percentage of second administrative level reporting at least 2 non-measles non-rubella cases per 100 000 population per year <math>\geq</math> 80%</li> </ul>
<ul style="list-style-type: none"> <li>There are still many provinces and districts with insufficient capacity for adequate case investigation (very low "proportion of suspected cases with adequate investigation initiated within 48 hours of notification").</li> </ul>	<p>3.3 Establish sufficient capacity for adequately investigating suspected measles and rubella cases in all provinces and districts</p>	<ul style="list-style-type: none"> <li>Percentage of suspected measles and rubella cases with adequate investigation<sup>2</sup> initiated within 48 hours of notification <math>\geq</math> 80%</li> </ul>

2. World Health Organization. Framework for Verifying Elimination of Measles and Rubella. Wkly Epidemiol Rec., 2014;88(9):89–99.

Activities	Annual Plan of Action 2018–2025							
	2018	2019	2020	2021	2022	2023	2024	2025
<ul style="list-style-type: none"> <li>a. Change surveillance case definition to acute fever and rash, if feasible<sup>3</sup></li> <li>b. Samples collected to investigate cases of acute fever and rash illness should be tested for rubella if found negative for measles, or tested simultaneously for measles and rubella</li> </ul>								
<ul style="list-style-type: none"> <li>a. Ensure sufficient capacity at all health facilities including private health facilities and health centres for prompt detection and reporting of all AFR cases (e.g. by regular training, supportive supervision visits)</li> <li>b. Conduct intersectoral advocacy, program communication and social mobilization to promote prompt detection and reporting of all AFR cases of all ages. This includes systematically engaging the private health sector, such as national or regional associations of health care providers</li> <li>c. Improve linkage of AFR surveillance with existing surveillance networks (e.g. Early Warning and Response [EWAR], surveillance for influenza, dengue, Zika, etc.)</li> <li>d. Encourage all provinces and districts to conduct active case searches not only when an outbreak is detected or suspected but also as part of regular surveillance performance assessment</li> <li>e. Conduct routine monitoring and supervision to ensure quality of surveillance data</li> <li>f. Provide regular feedback of surveillance data and performance to all levels of the system</li> </ul>								
<ul style="list-style-type: none"> <li>a. Ensure sufficient capacity at national, provincial and district levels for prompt and adequate investigation of AFR cases and management and analysis of data (e.g. by regular training, supportive supervision visit)</li> <li>b. Secure adequate operational resources to ensure case investigation with collection and transport of specimens for case confirmation and virus detection</li> <li>c. Ensure case investigation includes use of a common unique identifier to link laboratory and epidemiologic data</li> <li>d. Encourage all provinces and districts to conduct active case searches not only when an outbreak is detected or suspected but also as part of a regular surveillance performance assessment</li> <li>e. Ensure investigation of measles and rubella cases during both routine surveillance and outbreak investigation is able to classify cases as 1) imported or import-related; and 2) preventable or non-preventable</li> <li>f. Conduct routine monitoring and supervision to ensure the quality of surveillance data</li> </ul>								

3. Countries with high incidence of non-measles, non-rubella fever with rash illnesses may wish to consider leveraging existing surveillance networks, e.g. dengue or Zika, if applicable. Staged introduction of integrated AFR surveillance, for example, focusing initially on high-risk populations, may also be appropriate strategies in some settings.

### Strategic area 3 (continued)

## Progress monitoring and verification of elimination

Unresolved issues or emerging challenges	Strategy	Strategic targets
<ul style="list-style-type: none"> <li>There are still many provinces and districts with insufficient capacity for collecting and shipping adequate specimens from each outbreak or transmission (low “proportion of suspected measles and rubella cases with adequate specimen”).</li> </ul>	<p>3.4 Establish sufficient capacity for collecting and shipping specimens from suspected measles and rubella cases from each outbreak or transmission in all provinces and districts</p>	<ul style="list-style-type: none"> <li>Percentage of suspected measles and rubella cases with adequate specimens for detecting acute measles or rubella infection collected and tested in a proficient laboratory <math>\geq</math> 80%</li> </ul>
<ul style="list-style-type: none"> <li>CRS surveillance has not yet been established in many countries of the Region, resulting in the CRS disease burden continuing to be underestimated in these countries and in the Region.</li> </ul>	<p>3.5 Establish or expand CRS surveillance</p>	<ul style="list-style-type: none"> <li>CRS surveillance established</li> </ul>

Activities	Annual Plan of Action 2018–2025							
	2018	2019	2020	2021	2022	2023	2024	2025
a. Ensure sufficient capacity at provincial and district levels for collecting adequate and appropriate specimens <sup>4</sup> (e.g. by regular training, supportive supervision visit) for both serologic and molecular tests, at first contact with suspected cases								
b. Secure adequate operational resources to ensure case investigation with collection and transport of specimens for case confirmation and virus detection								
c. Ensure laboratory resources are efficiently used, by increasing appropriate use of epidemiologic linkage for case confirmation during large outbreaks								
d. Encourage all provinces and districts to conduct active case searches not only when an outbreak is detected or suspected but also as part of a regular surveillance performance assessment								
e. Conduct routine monitoring and supervision to ensure the quality of surveillance data								
a. Establish and eventually expand sentinel site surveillance for CRS (e.g. at a national paediatric hospital, major provincial hospitals)								
b. Monitor and improve CRS surveillance performance using standard indicators <sup>5</sup>								

4. Serum or oral fluid for serologic test, and throat swab, oral fluid or urine for molecular test. Adequate blood specimen: while IgM ELISA tests are more sensitive between days 4 and 28 after the onset of rash, a single serum sample obtained at the first contact with the health care system within 28 days after onset is considered adequate for measles surveillance (WHO-recommended standards for surveillance of selected vaccine-preventable diseases). For virus isolation, adequate throat swabs should be collected within 5 days after the onset of rash for measles and within 3 days after the onset of rash for rubella. Urine samples are not recommended for rubella. Throat swabs and urine can be collected up to 14 days after rash onset for RNA detection by RT-PCR although RNA detection rates are much lower after 7 days post rash onset. For laboratory confirmation of CRS, IgM may remain detectable for up to 1 year although IgM detection is most reliable between 3-6 months of age. Beyond 6 months of age, testing for IgG is recommended to confirm CRS. The persistence of IgG antibodies beyond 6 months of age has been detected in 95% of cases.
5. The Draft Strategic Plan for Accelerating Control of Rubella and Prevention of Congenital Rubella Syndrome in the Western Pacific Region (2010) proposes use of measles surveillance performance indicators for rubella (i.e. 1: discarded rubella rate of  $\geq 2$  per 100 000 population; 2: second level units with  $\geq 1$  discarded case per 100,000; 3: suspected cases with adequate investigation  $\geq 80\%$ ; 4: suspected cases with adequate blood specimens  $\geq 80\%$ ; and 5: laboratory results  $\leq 7$  days). However, standard indicators for CRS surveillance performance have not yet been endorsed for the Western Pacific Region and development of these should be considered a priority for the Region.

## Strategic area 4

### Laboratory support<sup>6</sup>

Unresolved issues or emerging challenges	Strategy	Strategic targets
<ul style="list-style-type: none"> <li>Some national measles and rubella laboratories (NMRLs) could not conduct serological testing of specimens and report results in timely manner during measles outbreaks.</li> <li>Some NMRLs were unable to efficiently integrate epidemiological and serological data due to lack of common unique identification numbers.</li> <li>Some NMRLs were overwhelmed by high numbers of laboratory samples collected during large measles outbreaks.</li> </ul>	<p>4.1 Ensure timely and appropriate laboratory diagnostic confirmation of suspected measles and rubella cases</p>	<ul style="list-style-type: none"> <li>Within 4 days of receipt of specimens in the laboratory, serological testing is carried out for at least 80% specimens received and these results are reported to the national immunization programme</li> <li>Laboratory testing and epidemiologic linkage for case confirmation are used together in a sustainable way that allows maximization of laboratory resources following confirmation of outbreaks</li> <li>All laboratory samples and epidemiological data collected during case investigation are labelled with the same unique identifier</li> </ul>
<ul style="list-style-type: none"> <li>Virological (genotype) information and data have not been adequately obtained in some countries and areas.</li> <li>Submission of monthly virological data to WPRO from some countries tends to be delayed, which has resulted in delays for WHO in sharing regional virological information with Member States and other WHO Regions.</li> <li>Appropriate clinical specimens (throat swabs or oral fluid) for genotyping are not always collected.</li> </ul>	<p>4.2 Ensure collection of appropriate clinical specimens for obtaining genotype information from each outbreak and transmission</p>	<ul style="list-style-type: none"> <li>All NMRLs accredited for molecular detection to obtain and report genotype data monthly</li> <li>All NMRLs to submit timely monthly case-based laboratory data (or line-lists) to WPRO</li> </ul>

6. See WHO/IVB/09.03 for guidance on appropriate testing protocols for outbreaks to meet the following objectives: confirmation of outbreaks: to confirm the clinical diagnosis in the early stages of an outbreak; confirmation of cases: to confirm or discard any suspected cases of measles or rubella; Identification of measles and rubella viral strains and genetic characterisation of viral isolates.

Activities	Annual Plan of Action 2018–2025							
	2018	2019	2020	2021	2022	2023	2024	2025
<ul style="list-style-type: none"> <li>a. Ensure access to adequate laboratory equipment, and sufficient supply of consumables (including testing kits), as well as budget for operational and shipping cost at NMRL</li> <li>b. During large-scale outbreaks, ensure specimens are collected not from all, but from only selected suspected cases (e.g. from first 5–10 suspected cases in a district or province for initial confirmation of an outbreak or from new areas of transmission, or if the outbreak lasts for more than 30 days to verify continued transmission)</li> <li>c. Ensure that common unique identification numbers are used to identify laboratory samples and epidemiological data in all case investigations</li> <li>d. Increase use of epidemiologic linkage during case investigation for routine case confirmation during confirmed outbreaks, and in times and places where sample collection or transportation is extremely difficult (such as during disasters and remote locations)</li> <li>e. Ensure NMRL to conduct the external quality assessment (EQA) programme for subnational laboratories and monitor their performance to ensure quality and the timeliness of testing</li> </ul>								
<ul style="list-style-type: none"> <li>a. Ensure both serologic and virologic samples are simultaneously collected at the first contact with suspected cases</li> <li>b. Ensure appropriate collection of adequate samples (throat swabs or oral fluid) for obtaining virological (genotype) data</li> <li>c. Ensure sufficient budget for laboratory equipment, consumables including reagents and kits, and operational and shipping costs</li> <li>d. Ensure NMRLs without capacity for molecular analysis send representative samples to RRL so that the country can obtain genetic information on both outbreaks and sporadic cases</li> <li>e. Encourage NMRLs without throat swab or oral fluid samples to refer positive serum samples to RRL to obtain genetic information from both outbreaks and sporadic cases to monitor elimination status</li> <li>f. Collaborate with WHO in monitoring and providing feedback on timeliness and completeness of NMRL reporting to WPRO</li> <li>g. Ensure NMRL regularly shares data with WPRO and submits genotype and sequence data to measles and rubella nucleotide surveillance databases (MeaNS and RubeNS)</li> </ul>								

## Strategic area 4 (continued)

### Laboratory support

Unresolved issues or emerging challenges	Strategy	Strategic targets
<ul style="list-style-type: none"> <li>• Arrival of samples for Proficiency Testing (PT) at some NMRLs tends to be delayed due to time required for obtaining import permission.</li> <li>• Submission of samples for confirmatory testing from some NMRLs to RRLs tends to be delayed.</li> </ul>	<p>4.3 Collaborate with WPRO to further improve the performance of the Regional Measles and Rubella Laboratory Network</p>	<ul style="list-style-type: none"> <li>• All NMRLs in the Region are regularly updated on progress and issues in the Regional Measles and Rubella Elimination Initiative as well as technical aspects of laboratory support to the initiative in order to maintain and further improve the performance of the Regional Laboratory Network</li> <li>• GSL, RRLs and NMRLs continue to meet accreditation standards to maintain the quality of work of regional network laboratories</li> <li>• All NMRLs in the Region receive PT samples in a timely manner</li> <li>• All NMRLs submit samples for confirmatory testing to RRL in a timely manner</li> <li>• All NMRLs receive technical updates regularly through meetings, workshops and hands-on trainings</li> <li>• All NMRLs, regional reference labs (RRLs) and global specialized lab (GSLs) are accredited</li> </ul>

Activities	Annual Plan of Action 2018–2025							
	2018	2019	2020	2021	2022	2023	2024	2025
<ul style="list-style-type: none"> <li>a. Prepare timetable/schedule of PT samples distribution early and share with NMRLs</li> <li>b. NMRLs secure import permit on time, in advance of the schedule of distribution of PT samples</li> <li>c. Liaise with Country Offices to facilitate receipt of PT samples by NMRLs</li> <li>d. Ensure NMRLs send samples for confirmatory testing to RRL as per agreed schedule (1–2 times a year)</li> <li>e. Evaluate results and provide recommendations to address significant problems</li> <li>f. Conduct on-site review/desk review</li> <li>g. Ensure laboratories implement recommendations made during the on-site/desk review</li> </ul>								

## Strategic area 5

### Programme review and risk assessment

Unresolved issues or emerging challenges	Strategy	Strategic targets
<ul style="list-style-type: none"> <li>Several countries that had reported high MCV-1 and MCV-2 coverage and/or reported to have conducted successful MCV-SIAs experienced measles resurgence, or large-scale or multiple measles outbreaks following importation(s), likely caused by residual and/or accumulating susceptible populations.</li> </ul>	<p>5.1 Detect programme deficiencies regularly and proactively, i.e. before a measles or rubella virus establishes transmission</p>	<ul style="list-style-type: none"> <li>Epidemiologic data are analysed, reported, and used at both the local and country level to identify unvaccinated or under-vaccinated populations, and geographic areas that need special immunization strategies or increased support of the immunization system</li> <li>High-risk areas, communities and populations with low immunization coverage are identified, specified and documented every year and necessary proactive and corrective actions taken in time</li> </ul>

Activities	Annual Plan of Action 2018–2025							
	2018	2019	2020	2021	2022	2023	2024	2025
<p>a. Conduct annual review of MR vaccination coverage (down to the lowest administrative unit), AFR surveillance data, surveillance performance indicators, and programme capacity (e.g. cold chain, vaccine supply, human resources, financing) to identify programme deficiencies, communities at risk, and immunity gaps by geographic area (e.g. districts, health center catchment areas) and by birth cohort</p> <p>b. Conduct regular analysis of coverage data quality for both routine immunization programme and mass vaccination campaign<sup>7</sup></p> <p>c. Periodic serological surveys can be a useful complementary data point to validate vaccination coverage estimates, and provide a direct measurement of population immunity</p> <p>d. Conduct regular analysis, at the local level as well as the country level, of the epidemiology of measles, rubella and CRS cases, outbreaks and chains of transmission, using multiple complementary data sources, including coverage data, linked laboratory and epidemiologic data from integrated AFR surveillance, and genotyping data, to minimize the gaps in each individual data source. Existing tools, such as the WHO Programmatic Risk Assessment Tool for Measles<sup>8</sup>, may be useful to help in synthesizing data to identify high risk districts, and generate summary results that can be used for advocacy, resource mobilization, and prioritization of programmatic activities</p> <p>e. Develop and implement special strategies addressing vaccine refusal / hesitancy, language or cultural barriers among minority populations and immigrant, mobile or other marginalized or socioeconomically disadvantaged population groups</p> <p>f. Closely monitor epidemiologic situation of measles and rubella in countries from / to which travellers and migrants come and go</p>								

7. Reported vaccination coverage should be validated and poor performance identified during supervision visits through use of rapid convenience assessment (RCA), lot quality assurance sampling (LQAS) or 100 household surveys. Periodically 30-cluster coverage surveys and data quality self-assessments (DQS) should also be carried out.
8. The WHO Measles Programmatic Risk Assessment Tool and user guide are available for download at [http://www.who.int/immunization/monitoring\\_surveillance/routine/measles\\_assessment](http://www.who.int/immunization/monitoring_surveillance/routine/measles_assessment).

## Strategic area 6

### Outbreak preparedness and responses

Unresolved issues or emerging challenges	Strategy	Strategic targets
<ul style="list-style-type: none"> <li>Sufficient outbreak response capacity has not yet been established at national and provincial levels in several countries.</li> </ul>	<p>6.1 Ensure standardized outbreak response procedures are in place at all levels</p>	<ul style="list-style-type: none"> <li>National plans and standardized operation procedures (SOP) for outbreak response are developed or updated and disseminated to all stakeholders and health facilities in the countries</li> </ul>
<ul style="list-style-type: none"> <li>Investigation materials and contingency funds for outbreak investigation were insufficient at provincial or district levels and delays in disbursement from the national level led to delays in outbreak investigation in several countries.</li> </ul>	<p>6.2 Ensure necessary resources are in place before or right after an outbreak is detected</p>	<ul style="list-style-type: none"> <li>Outbreak investigation materials are made available at all provincial and district health offices</li> <li>Contingency funds for outbreak investigation are secured at national level</li> </ul>
<ul style="list-style-type: none"> <li>Outbreak investigations were not carried out promptly and properly in several countries.</li> </ul>	<p>6.3 Conduct prompt and thorough outbreak investigations</p>	<ul style="list-style-type: none"> <li>Capacity for appropriate outbreak investigation established at the national immunization programme, all provincial and district health departments</li> </ul>

Activities	Annual Plan of Action 2018–2025							
	2018	2019	2020	2021	2022	2023	2024	2025
<p>a. Develop or update a national plan for outbreak response, that include emergency response infrastructure (including delineation of incident response hierarchy, sub-groups and responsibilities, and pre-identified roles), SOP (including procedures for response activation information management and flow, and response de-activation) and contingency planning (including surge capacity)</p> <p>b. Ensure all levels are provided with the national plan and SOP for outbreak response</p> <p>c. Conduct regular training for national, provincial and district staff to ensure all outbreak focal persons are familiar with the plan and SOP</p>								
<p>a. Ensure all relevant materials for case investigation (e.g. guidelines, case investigation forms, specimen collection supplies) are available to surveillance officers and clinicians in peripheral levels</p> <p>b. Ensure contingency funds for outbreak investigation are available at the national level with prompt disbursement of the funds to provincial or district levels when an outbreak is suspected</p> <p>c. Ensure adequate laboratory support for timely testing and reporting</p> <p>d. Identify personnel such as epidemiologists and other healthcare professionals that can fill response roles as surge capacity when human resources are stressed during a large outbreak, to perform key activities such as contact tracing, case investigation, clinical management, laboratory testing and infection prevention and control activities, appropriate with their professional background. This planning should also include development of procedures and mechanisms to activate, deploy and pay these personnel as part of outbreak preparedness planning</p>								
<p>a. Ensure protocols and training materials for surveillance and outbreak investigations are updated or developed to include: critical data to be collected; criteria for laboratory confirmation; guidelines for analysis; interpretation of analysis results; and presentation of the data</p> <p>b. Ensure cases are investigated with collection of core variables<sup>9</sup> and specimens are appropriately collected and submitted to the laboratory</p> <p>c. Ensure that investigation of measles and rubella cases during both routine surveillance and outbreak investigation is able to classify cases as 1) endemic, imported or import-related; and 2) previously vaccinated or not vaccinated</p> <p>d. Enhance active case search in the surrounding communities and alert clinicians about the suspected outbreak</p> <p>e. Measure risk status in the affected and surrounding districts, and among high-risk groups</p> <p>f. Carefully examine the age distribution of cases in order to appropriately target outbreak response measures</p> <p>g. Identify epidemiologic linkage of cases (reduce the proportion of clinically-compatible cases and increase the proportion of epidemiologically-linked cases) and document chains of transmission</p>								

9. Twelve core variables are recommended by the WHO Framework for verifying elimination of measles and rubella: 1) name or identifiers; 2) place of residence; 3) place of infection (to district level or lower); 4) age or date of birth; 5) sex; 6) date of rash onset; 7) date of specimen collection; 8) measles-rubella vaccination status; 9) date of last MR or MMR vaccination; 10) date of notification; 11) date of investigation; and 12) travel history.

## Strategic area 6 (continued)

### Outbreak preparedness and responses

Unresolved issues or emerging challenges	Strategy	Strategic targets
<ul style="list-style-type: none"> <li>Outbreak response immunization was not carried out promptly or with appropriate target population size in several countries during the recent measles resurgence or outbreaks.</li> </ul>	<p>6.4 Conduct timely outbreak response immunization targeting appropriate geochartical areas and birth cohorts</p>	<ul style="list-style-type: none"> <li>Detection and vaccination of previously unvaccinated persons initiated immediately after an outbreak is suspected</li> <li>Planning and preparation in place to ensure a non-selective SIA, targeting appropriate geographical areas and birth cohorts, can be carried out within 2 weeks of an outbreak being confirmed<sup>10</sup></li> </ul>
<ul style="list-style-type: none"> <li>High case fatality rate were reported in several countries.</li> </ul>	<p>6.5 Ensure all health facilities provide appropriate clinical management of suspected measles, rubella and CRS cases</p>	<ul style="list-style-type: none"> <li>Case management protocols for measles, rubella and CRS are available at all health facilities</li> </ul>
<ul style="list-style-type: none"> <li>Measles transmissions and outbreaks were amplified in hospitals and by health staff in several countries during the recent measles resurgence or outbreaks.</li> </ul>	<p>6.6 Prevent nosocomial transmission</p>	<ul style="list-style-type: none"> <li>Nosocomial transmission of measles and rubella prevented during outbreaks</li> </ul>

10. Refer to *Measles Elimination Field Guide*, WHO Regional Office for the Western Pacific (2013).

Activities	Annual Plan of Action 2018–2025							
	2018	2019	2020	2021	2022	2023	2024	2025
<ul style="list-style-type: none"> <li>a. Ensure that all household, community and health-care contacts<sup>11</sup> without history of vaccination or illness are detected and provided with MRCV</li> <li>b. Conduct a district-wide or province-wide non-selective MRCV-SIAs when the above activity i) does not stop transmission or ii) multiple communities are affected by outbreaks</li> <li>c. Consider supplementary vaccine doses for unvaccinated children 6 months and older who are not yet age eligible for the first dose of MCV1 in the national immunization programme<sup>12</sup></li> <li>d. Consider supplementary vaccine doses for post-partum mothers, their families and caregivers for newborns to protect infants aged &lt;6 months and reduction of case fatality during outbreaks</li> </ul>								
<ul style="list-style-type: none"> <li>a. Develop national case management protocols for measles, rubella and CRS</li> <li>b. Ensure all health facilities are provided with the national case management protocols</li> <li>c. Conduct regular training for national, provincial and district staff to ensure all health staff are familiar with the case management protocols</li> </ul>								
<ul style="list-style-type: none"> <li>a. Ensure all health workers are immune to measles and rubella (e.g. vaccination of health workers)</li> <li>b. Develop national guidelines for preventing the nosocomial transmission of measles and rubella viruses, including infection from CRS cases. Guidelines should include appropriate triage, patient placement and airborne isolation precautions</li> <li>c. Ensure all health facilities are provided with the national guidelines</li> <li>d. Conduct regular training for national, provincial and district staff to ensure all health staff are familiar with the guidelines</li> <li>e. Ensure that all health care associated cases are promptly investigated, including contact tracing with appropriate post-exposure measles prophylaxis to exposed patients, family members, and health workers</li> <li>f. Develop public messages on the isolation of suspected cases and care of uncomplicated cases at home</li> <li>g. Furlough all health-care workers who have suspected or confirmed measles or rubella, from the first day of symptoms until 4 days after rash onset. Furlough all susceptible health workers who have been exposed to a suspected or confirmed measles or rubella case, from 5 days until 21 days following exposure, regardless of symptoms, and regardless of post-exposure prophylaxis</li> </ul>								

11. Contacts are defined as all persons living in a household or other close quarters with the case during the infectious period (five days before to five days after the onset of the rash). (Field Guidelines for Measles Elimination, WHO Regional Office for the Western Pacific, WHO, 2004).

## Strategic area 7

### Partnership, advocacy, IEC and social mobilization

Unresolved issues or emerging challenges	Strategy	Strategic targets
<ul style="list-style-type: none"> <li>Partnerships for regional measles and rubella elimination are not yet strong enough.</li> </ul>	<p>7.1 Revitalize or establish immunization partnerships for measles and rubella elimination at both national and regional levels</p>	<ul style="list-style-type: none"> <li>A regional partnership for promoting measles and rubella elimination activities established in the Western Pacific</li> </ul>
<ul style="list-style-type: none"> <li>While the Regional Verification Commission (RVC) was established in 2012, and Sub-Regional and National Verification Committees (SRVC and NVCs) were established in 2012 and 2013–2014, respectively, “advocacy” as one of their core functions and ToR has not been fully implemented.</li> </ul>	<p>7.2 Enhance advocacy activities by RVC, SRVC and NVCs for measles and rubella elimination</p>	<ul style="list-style-type: none"> <li>Each NVC develops and conducts advocacy activities for promoting measles and rubella elimination and reports its activities in the annual NVC report</li> <li>RVC coordinates with WHO in developing a regional partnership for promoting measles and rubella elimination activities</li> </ul>
<ul style="list-style-type: none"> <li>The general public and minority groups in several countries still have very limited knowledge about measles, rubella, CRS and importance of their prevention by vaccination.</li> </ul>	<p>7.3 Develop and implement IEC strategies for increasing knowledge of the general public about measles, rubella, CRS and importance of their prevention by vaccination</p>	<ul style="list-style-type: none"> <li>A communication strategy, and information, education, and communications (IEC) materials and programme developed in local language with consideration of country-specific situation</li> </ul>
<ul style="list-style-type: none"> <li>There are no regular activities in several countries to mobilize local governments, private sectors, societies, communities and families for promotion of measles and rubella elimination activities.</li> </ul>	<p>7.4 Mobilize local governments, private sectors, societies, communities and families regularly for promoting measles and rubella elimination activities (including defaulters, MR vaccination and case detection and reporting)</p>	<ul style="list-style-type: none"> <li>National Immunization Week carried out with involvement of local governments, private sectors, societies, communities and families for promotion of measles and rubella elimination activities</li> </ul>

Activities	Annual Plan of Action 2018–2025							
	2018	2019	2020	2021	2022	2023	2024	2025
<p>a. Revitalize functions of the Inter-Agency Coordination Committee (ICC) for measles and rubella elimination through regularly reviewing progress and challenges in measles and rubella elimination and discussing interagency collaboration for measles and rubella elimination</p> <p>b. Establish or enhance inter-ministerial coordination and collaboration and public-private partnership (PPP) for promoting MR vaccination for school-entry vaccination history checks and immunization requirements, vaccination for student at entry or at school and vaccination for high-risk groups, e.g. factory workers, transportation and hospitality workers, military personnel, police and others living or working in communal settings</p>								
<p>a. Ensure National Immunization Technical Advisory Groups (NITAG) and National Verification Committees (NVC) regularly review and discuss progress and challenges in measles and rubella elimination and provide technical advice to the Ministry of Health</p> <p>b. Strengthen the advocacy functions of RVC, SRVC and NVCs in raising awareness of and commitment to measles and rubella elimination, targeting high-ranking health officials, health professionals, partners and political leaders through multiple channels such as national health conferences, scientific seminars, media and personal networks</p> <p>c. Conduct periodic national reviews on progress towards measles and rubella elimination in countries with endemic or prolonged transmission in particular with participation of RVC, WHO and other international partners</p> <p>d. Establish or enhance inter-ministerial coordination and collaboration and public-private partnership (PPP) for advocating measles and rubella elimination and CRS prevention</p>								
<p>a. Establish partnership with social media and NGOs and disseminate knowledge and awareness on measles, rubella, CRS and importance of their prevention by vaccination through social media, e.g. radio, TV and social media networks</p>								
<p>a. Actively involve and coordinate with local governments, the private sector, societies, communities and families in organizing the National Immunization Week (NIW), in which the measles and rubella elimination and CRS prevention is ensured to be part of the regular agenda every year</p> <p>b. In countries with large population (e.g. &gt; 50 million population), establish a provincial Measles Elimination Coordinating Committee to provide the strategic and technical guidance to the provincial health department in developing the provincial plan, as well as assistance in its implementation</p>								

## Strategic area 8

### Progress monitoring and verification of elimination

Unresolved issues or emerging challenges	Strategy	Strategic targets
<ul style="list-style-type: none"> <li>The region has not yet finalized criteria and lines of evidence for rubella elimination verification.</li> </ul>	<p>8.1 Update and finalize the Guidelines for Verification to include rubella</p>	<ul style="list-style-type: none"> <li>Criteria and lines of evidence for verification of rubella elimination finalized in 2017</li> <li>Progress towards and verification of rubella elimination documented by NVCs and verification process started by RVC in 2017</li> </ul>
<ul style="list-style-type: none"> <li>RVC recommendations to NVCs have not yet been fully reflected in the national measles and rubella elimination programme in several countries.</li> </ul>	<p>8.2 Ensure that RVC and NVCs prepare strategic recommendations for further progress towards elimination in each country and NVC to actively encourage MOH to implement RVC's recommendations</p>	<ul style="list-style-type: none"> <li>Countries with resurgence in 2013–2016 or with on-going transmission should be provided with strategic recommendations prepared by NVC with endorsement and input from RVC</li> <li>RVC recommendations to NVCs should be reflected in a timely manner in implementation of measles and rubella elimination activities</li> </ul>

Activities	Annual Plan of Action 2018–2025							
	2018	2019	2020	2021	2022	2023	2024	2025
<p>a. RVC and WHO update the current regional guidelines on verification of measles elimination adding criteria and lines of evidence for rubella elimination</p> <p>b. RVC and WHO support NVCs in developing an annual NVC report documenting progress towards and status of rubella elimination using an updated regional guidelines on verification of measles elimination with additional criteria and lines of evidence for rubella elimination</p>								
<p>a. Periodically conduct RVC member advocacy visits and/or national reviews of progress towards measles and rubella elimination in countries with endemic or prolonged transmission in particular with participation of NVC, RVC, WHO and other international partners and prepare strategic recommendations for further progress towards elimination for the government</p>								









