7TH ANNUAL MEETING OF THE REGIONAL VERIFICATION COMMISSION FOR MEASLES AND RUBELLA ELIMINATION IN THE WESTERN PACIFIC

24–28 September 2018
Kuala Lumpur, Malaysia
Participants of the Seventh Annual Meeting of the Regional Verification Commission for Measles and Rubella Elimination in the Western Pacific
24–28 September 2018
Kuala Lumpur, Malaysia
MEETING REPORT

SEVENTH ANNUAL MEETING OF THE REGIONAL VERIFICATION COMMISSION FOR MEASLES AND RUBELLA ELIMINATION IN THE WESTERN PACIFIC

Convened by:

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NOTE

The views expressed in this report are those of the participants of the Seventh Annual Meeting of the Regional Verification Commission for Measles and Rubella Elimination in the Western Pacific and do not necessarily reflect the policies of the conveners.

This report has been prepared by the World Health Organization Regional Office for the Western Pacific for Member States in the Region and for those who participated in the Seventh Annual Meeting of the Regional Verification Commission for Measles and Rubella Elimination in the Western Pacific in Kuala Lumpur, Malaysia from 24 to 28 September 2018.
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Measles – prevention and control / Rubella – prevention and control / Vaccination / Diseases eradication
SUMMARY

The Seventh Annual Meeting of the Regional Verification Commission for Measles and Rubella Elimination in the Western Pacific Region (RVC) was held in Kuala Lumpur, Malaysia, from 24 to 28 September 2018. At this meeting, the RVC reviewed progress by Member States towards measles and rubella elimination.

The objectives of the meeting were:

1. to review and assess the annual progress reports of 16 national verification committees and the Pacific Subregional Verification Committee;
2. to verify achievement or maintenance of measles and/or rubella elimination for countries and areas that report to have achieved these goals; and
3. to prepare country-specific recommendations for achievement and maintenance of measles and/or rubella elimination.

From 2014 to 2017, eight countries and two areas were verified as having achieved and maintained measles elimination, and two countries were verified as having achieved rubella elimination, each for a period of at least 36 months. In 2018, Singapore was verified as having achieved measles elimination; and Australia, Brunei Darussalam and Macao SAR (China) were verified as having achieved rubella elimination.
1. INTRODUCTION

1.1 Meeting organization

The Seventh Annual Meeting of the Regional Verification Commission for Measles and Rubella Elimination in the Western Pacific (RVC) was held in Kuala Lumpur, Malaysia, from 24 to 28 September 2018. Participants included 10 RVC members, five staff members from the WHO Regional Office for the Western Pacific, one staff member from WHO headquarters and one technical adviser from the United States Centers for Disease Control and Prevention. The list of participants is available in Annex 1, and the agenda and timetable for the meeting are available in Annex 2.

1.2 Meeting objectives

The objectives of the meeting were:

1. to review and assess the annual progress reports of 16 national verification committees (NVCs) and the Pacific Subregional Verification Committee (SRVC);
2. to verify achievement or maintenance of measles and/or rubella elimination for countries and areas that report to have achieved the goals; and
3. to prepare country-specific recommendations for achievement and maintenance of measles and/or rubella elimination.

2. PROCEEDINGS

2.1 Opening session

The meeting was called to order by Dr Yoshihiro Takashima. Dr Mark Jacobs delivered the opening remarks on behalf of Dr Shin Young-soo, WHO Regional Director for the Western Pacific. Dr Jacobs thanked the participants for their support of measles elimination. He reviewed the resolutions adopted by the WHO Regional Committee for the Western Pacific that established the mechanisms to form NVCs. He acknowledged the verification in 2017 of one more country in the Region as having achieved interruption of endemic measles virus transmission for a period of at least 36 months, and that, for the first time, two new countries were verified as having eliminated endemic rubella. He recognized Member States’ efforts to achieve measles elimination and thanked the RVC members for their willingness to continue their service.

Dr Jacobs nominated the office bearers as follows: Chair – Professor David Durrheim; Vice-Chair – Dr Hiroshi Yoshikura; and Rapporteur – Dr Maria Rosario Capeding.

2.2 Global update on measles and rubella elimination

Among the key highlights of this session were the updated 2017 figures for global measles-containing vaccine first dose (MCV1), second dose (MCV2) and rubella-containing vaccine (RCV) coverage (85%, 67% and 52%, respectively) and general discussion of progress towards the World Health Assembly 2010 measles targets and 2012 Global Vaccine Action Plan regional goals. Overall, only the Region of the Americas had achieved its elimination goals, having eliminated rubella in 2015 and measles in 2016; however, a prolonged outbreak of measles in the Region led to loss of measles verification status in 2018. Other global developments discussed included an overview of the changes to criteria and lines of evidence in the newly updated WHO Global Verification Framework for Measles and Rubella Elimination, and an overview of the progress towards establishing a global measles eradication goal.
2.3 Measles and rubella elimination in the Western Pacific Region: overview, progress in 2017–2018 and issues to be addressed in 2018–2020

Despite the resurgence of measles from 2013 to 2016, progress has been made in achieving high population immunity in the Region. A second dose of measles-containing vaccine (MCV) has been introduced in all Member States except Solomon Islands (planning to introduce in 2018) and Vanuatu. The overall two-dose MCV coverage is 93% region-wide, but there is still wide variation in coverage among Member States. More than 40.84 million MCV doses were administered via supplementary immunization activities (SIAs) during 2014–2017 in 10 countries. As a result, measles and rubella incidence declined in 2017 in Western Pacific Member States. Measles incidence in the Region reached a historic low of 5.2 cases per 1 million population, with 77% of Member States reporting fewer than five cases per 1 million population in 2017.

A new Regional Strategy and Plan of Action for Measles and Rubella Elimination in the Western Pacific was developed to guide the Region’s response to newly identified challenges during the measles resurgence of 2013–2016 and incorporate lessons learnt. In 2017, this document was endorsed by the WHO Regional Committee, which also decided that Member States should aim to eliminate rubella as soon as possible and that they should each establish a target year for rubella elimination. To further guide Member States in achieving measles and rubella elimination, final verification guidelines for measles and rubella elimination in the Western Pacific Region, and a draft field guide for congenital rubella syndrome (CRS) surveillance in the Region were developed in 2017.

2.4 Virologic surveillance of measles and rubella in the Western Pacific Region

The regional measles and rubella laboratory network in the Western Pacific Region is composed of 386 laboratories, including 1 global specialized laboratory (GSL), 3 regional reference laboratories (RRLs), 17 national laboratories, 3 subnational laboratories, and in China 31 provincial and 331 prefecture laboratories. Laboratories in the network have maintained high proficiency of testing, implemented strong quality assurance programmes, and provided laboratory confirmation and genotype evidence to support measles and rubella elimination and verification in the Region. Three predominant genotypes – H1, D8 and B3 – were detected in the Region during 2017–2018; only a small number of D9 viruses were detected in 2017 and none in 2018. The prevalence of H1 has significantly decreased over the last three years, now representing only a third of all circulating viruses in the Region. Rubella genotype 2B continued to co-circulate in some countries with re-emergence of 1E across the Region. Available genotype data, especially availability of distinct genetic lineages/variants, will provide critical evidence in support of interruption of endemic measles transmission.

2.5 Unresolved issues related to CRS surveillance for rubella verification

Draft operational guidelines for CRS surveillance were developed in response to the recommendations of the 26th Meeting of the Technical Advisory Group on Immunization and Vaccine-Preventable Diseases in the Western Pacific Region in 2017. CRS is a serious consequence of rubella infection during early pregnancy, with a wide range of manifestations that cause early mortality or life-long disability. Hearing impairment, congenital heart defects and vision impairment are the most common symptoms and occur in about 80% of infants with CRS. Infants with CRS may have prolonged viral shedding for up to 12 months, which therefore may lead to secondary infections of nonimmune caregivers and other contacts. CRS surveillance serves three main purposes: (i) fill weaknesses in rubella surveillance, as up to 50% of rubella cases are asymptomatic or subclinical; (ii) collect data for advocacy and to inform public health action; and (iii) support evidence of rubella elimination. The WHO Regional Office has developed draft operational guidelines on how CRS surveillance systems may be tailored to local context to achieve the first two aims. However, the “minimum standard” CRS surveillance required to adequately support evidence of rubella elimination is still undefined, as the effectiveness of a given CRS surveillance design is highly dependent on local context. Guidance from the Strategic Advisory Group of Experts on Immunization (SAGE) Measles
and Rubella Working Group on this topic will further guide the RVC and WHO on how to guide Member States in the Region in establishing and evaluating CRS surveillance for the purpose of documenting rubella elimination.

2.6 Final Regional Strategy and Plan of Action for Measles and Rubella Elimination

During the region-wide measles resurgence in 2013 to 2016, new challenges were identified: (i) increased measles virus transmission among age groups not targeted by existing strategies (adolescents, young adults, and infants below vaccination age); (ii) subnational variation of measles epidemiology in large countries; (iii) delayed and improper outbreak response; (iv) serious nosocomial transmission; (v) surveillance and laboratory activities lacking resilience during outbreaks in some countries; and (vi) insufficient involvement, partnership and collaboration of communities and other ministries, sectors and partners. A Regional Strategy and Plan of Action for Measles and Rubella Elimination in the Western Pacific was developed to guide the Region’s response to these newly identified challenges, and incorporate lessons learnt. Advocacy by the RVC members to their respective governments was key in ensuring this document obtained the full consideration of Member States and endorsement by the WHO Regional Committee, so that it can now serve as a guide to support Member States in their development of national, subnational and subregional plans of action.

2.7 Country and area reports

2.7.1 Australia

Epidemiology of measles and rubella: In 2017, 81 measles cases were reported, with 38 (47%) importations. Two outbreaks had at least 9 cases. Of the local transmission events, 95% occurred in individuals of zero dose, or unknown vaccination status.

In 2017, 11 rubella cases were reported, all over 10 years of age. Of the five local transmission events, four adolescents had two doses and an adult had a single dose. Historical measles control campaigns in 1998 and 2001 had a dramatic impact on rubella circulation, decreasing incidence and protecting infants. Annual seasonality also disappeared after 2002. Rubella incidence has been below 1 million since 2014. Since 2012, 86% of cases have been over 20 years of age and 31% of these cases have been associated with importation. The four congenital rubella syndrome cases detected since 2012 were results of international infection.

Quality of measles and rubella surveillance: Australia maintained its sensitive epidemiological and laboratory surveillance in 2017. Surveillance quality assessment was based on non-standard indicators. All cases reported in 2017 were investigated, and laboratory testing was performed for 73 cases (90%) of measles; classification of measles cases by defined source of infection improved from 56% in 2016 to 86% in 2017.

Mandatory notification for rubella started in 1991. A standard case definition for rubella cases was adopted in 2004. As with measles, suspected rubella cases are subject to investigation at the local level but are not systematically reported to the national level. Standard performance indicators cannot be calculated, but are based on reporting of polymerase chain reaction (PCR) testing for rubella (presumably done for confirmation of diagnosis) from seven of eight territories. The non-rubella discard rate has been improving and nationally achieved the target of at least 2 discarded cases per 100 000 population since 2013. Except for Queensland and Western Australia, the territories have not achieved the discard rate in any year between 2012 and 2017.

Epidemiological investigation of confirmed cases is adequate. For adequacy of specimen collection, when PCR is used, adequate samples should be defined as collected within five days of rash onset. The quality and proportion of cases classified by defined source of infection has been increasing since 2012.

CRS has been nationally notifiable since 1991; both probable and confirmed cases are reported (four cases reported between 2012 and 2017). Besides passive surveillance (National Notifiable Diseases Surveillance Scheme), the Australian Paediatric Surveillance Unit conducts active surveillance for
congenital rubella infection and CRS. A capture-recapture study showed that National Notifiable Diseases Surveillance Scheme CRS surveillance sensitivity has been 100% between 2003 and 2016.

**Measles and rubella population immunity:** The majority of the country has more than 93% coverage of one dose of measles, mumps and rubella vaccine (MMR1), but MMR2 coverage is still lagging, and there are some isolated areas of concern for the 2015 birth cohort. Evidence at the five-year check suggests that the requisite doses are obtained by the age of 5 years/school entry.

Due to historical vaccination policies, rubella immunity differs by sex in older ages, with males having around 84% immunity and females 11% higher. This discrepancy continues to be observed in subsequent serological surveys.

The report estimated an effective reproduction number below 1 for both measles and rubella, based on the proportion of importations to locally transmitted cases.

**Programme sustainability:** The states and territories provided examples of strategies for improving community acceptance and examples of rapid outbreak response activities.

The National Immunisation Program is fully funded, and the two-dose schedule has been adjusted to provide the second dose with the minimal interval to increase overall population immunity and increase uptake of varicella vaccine.

**Genotype evidence:** Measles genotyping was completed for each of the seven outbreaks. All cases were laboratory confirmed, except for three outbreaks associated epi-linked cases. More than 85% of cases could be associated with a genotype, based on the report. Three different genotypes were reported, with further differentiation within genotypes, which was difficult to observe in the presented format.

Rubella genotype was reported as 1F in three cases.

### 2.7.2 Brunei Darussalam

**Epidemiology of measles and rubella:** No cases of measles or rubella were detected in 2017, though there were at least 19 suspected cases. An average of 15 suspected cases have been tested annually since 2009 and nine cases detected through 2014. The three young cases were below 1 year of age and too young to vaccinate; the other six cases were over 15 years of age and primarily female.

**Quality of measles and rubella surveillance:** All the surveillance performance indicators met WHO targets, including discard rates in all four districts for the past eight years. The Virology Laboratory of the Department of Laboratory Services, Ministry of Health is the WHO National Measles and Rubella Laboratory for Brunei Darussalam, and a member of the WHO measles laboratory network in the Region. There is active surveillance for suspected measles cases admitted in all paediatric wards across the country. Concurrent testing for measles and rubella is performed on samples from acute fever and rash (AFR) cases. Congenital rubella is not notifiable by law.

The country appears to conduct parallel serologic testing for measles and rubella. The lab has had ISO 15189 accreditation since 2011, and in 2014 joined the measles and rubella regional laboratory network. Surveillance for measles and rubella has exceeded the sensitivity indicator (discard rate of 2/100 000) since 2013.

**Measles and rubella population immunity:** In 2003, the Infectious Diseases Order required all children to be vaccinated according to the National Childhood Immunisation Programme. All vaccines are provided free of charge to children below the age of 5 years.

During routine visits, school health nurses review immunization cards and conduct vaccination where needed. High levels of vaccination coverage achieved at 12 and 18 months of age with measles- and rubella-containing vaccine (MRCV) (over 95% for the past four years).

**Programme sustainability:** There is demonstrated commitment and dedication to the prevention of vaccine-preventable diseases (VPDs), including measles and rubella. All children are required to be vaccinated according to the national immunization schedule, which are provided for free.
Genotype evidence: As there were no cases of either disease in 2017, there was no genotype information. There has been an agreement since 2014 to send specimens to the Victorian Infectious Diseases Reference Laboratory in Australia for genotyping.

2.7.3 Cambodia

Epidemiology of measles and rubella: A total of 10 cases were reported in 2017, the last of which had an onset in June; nine cases were classified as import-related and 80% were younger than 5 years of age.

Rubella cases have been decreasing since 2014. Seven rubella cases were identified among measles-negative AFR cases, six were below the age of 1 year. There has been significant decline in rubella cases since the introduction of the MR and wide-age campaign. Two CRS cases were identified in 2014 and 18 suspected cases investigated through CRS surveillance in 2017; all tested negative.

Quality of measles and rubella surveillance: Cambodia has strong surveillance and good case investigation with the ability to classify cases as import-related through case investigation. All indicators meet the targets, including second-level administrative unit sensitivity. CRS surveillance has been ongoing in one site since 2011. In 2016, Cambodia established CRS sentinel site surveillance at Angkor Hospital for Children with support from WHO, now with three operating sites in total. Of 18 suspected CRS cases, 17 came from a new site established in 2017.

Measles and rubella population immunity: Cambodia has high population immunity at a national level, especially among those older than 29 years, with more than 100% MR1 and 83% MR2 coverage, but there is large subnational variability. MR1 coverage in five of 25 provinces was below 80%, and only seven of 25 provinces had MR2 coverage above 80%. Performance at the district level was poorer.

Intensified activities to reach defaulters are ongoing. The MR0 policy for those younger than 9 months continues, which could have some negative impact on immunogenicity to subsequent doses and may not be appropriate in the elimination setting. Challenges with unreliable population estimates make it difficult to understand true coverage.

Programme sustainability: There is high commitment to sustain elimination status for measles, with good investment by the Government in filling immunity gaps through high-risk targeted outreach. The Government is in the process of setting a target date for rubella elimination.

Genotype evidence: Eight measles genotypes were submitted: four were B3 in two subgroupings, four were D8 (internationally common strain); and two measles cases were not possible to type. No rubella genotype was available.

2.7.4 China

Epidemiology of measles and rubella: Measles incidence in 2017 was 4.3 per million population (with five deaths), less than one fifth of the annual cases during 2013–2016. Spot maps demonstrate high variability throughout the country. The most affected age group was those younger than 5 years at 40.9 cases per million children and highest overall in infants (123 per million). A quarter of all cases were aged 8–24 months, and 30% were adults over 20 years old, continuing a bimodal age distribution. In cases below age 15, 25% reported two-dose vaccination, 23% had one-dose vaccination, and 20% had an unknown vaccination history.

Rubella incidence was 1.2 per million population, a historic low for the country. The seasonality of cases has been greatly reduced. Distribution of rubella cases varied across provinces but affected different provinces than measles. The highest incidence was over 3 per million in those 10–19 years of age. Two outbreaks were reported: one in a middle school and one at a company.

Quality of measles and rubella surveillance: Three adult importations were identified, including one in a Chinese national.

In 38 reported measles outbreaks, all were laboratory confirmed and 31% had an associated genotype.
China achieved or surpassed the threshold for all surveillance quality indicators, except for the proportion of second-level units that reported at least two discarded cases; it fell from 81% in 2016 to 59% in 2017.

For integrated measles and rubella surveillance, since 2014, the suspected case definition combines the WHO clinical case definitions of both diseases: “fever, maculopapular rash and any of the following: cough, coryza, conjunctivitis, cervical and/or suboccipital and/or postauricular adenopathy, or arthralgia/arthritis, or any case for which a health worker suspects measles or rubella infection”.

In 2017, 76% of reported cases were laboratory confirmed. The proportion of confirmed rubella cases has increased significantly since 2014, after new guidelines were introduced including use of the clinical rubella case definition (as opposed to AFR as a case definition).

China achieved or surpassed the threshold for all surveillance quality indicators, except for the proportion of second-level units that reported at least two discarded cases; it fell from 81% in 2016 to 59% in 2017.

In 2009, China began a pilot project on CRS surveillance in two provinces (four prefectures). By 2013, a total of 1670 suspected CRS cases were investigated and five laboratory-confirmed CRS cases identified. The pilot project and CRS surveillance ended in 2016.

**Measles and rubella population immunity:** A zero dose at 6–7 months of age for outbreak settings is part of the immunization schedule. Reported measles coverage was over 99% for both doses, and over 98% for rubella, with 5.4 million MCV doses were provided in 2017 through SIAs.

Most rubella cases were in the 7–19 years age group and were mostly unvaccinated or of unknown status. The younger age groups appear to have a higher prevalence of vaccination, though the high proportion of cases 2–6 years old with two doses is concerning.

Modelling from a serosurvey (reported in 2015) shows reduction of the measles effective basic reproduction number ($R$) from 18 to 2.3, as well as a risk of rubella outbreaks in the next decade.

**Programme sustainability:** The national government continues to support measles elimination and guarantees vaccine for the National Immunization Programme, while local governments are responsible for operational costs such as staff salaries. There is a strong commitment to the development and success of the laboratory network at all levels. A new plan of action for MR elimination was drafted in 2017.

**Genotype evidence:** H1 is still predominant; in addition, one B3 and 13 D8 cases were identified.

The China measles laboratory network began in 2001. The Chinese Center for Disease Control and Prevention Measles Lab has been WHO accredited since 2003 and is responsible for measles genotyping and molecular analysis. Viral isolation and PCR are conducted at provincial labs. Prefecture labs conduct specimen collection and serologic diagnosis.

All rubella strains were 2B.

### 2.7.5 Hong Kong SAR (China)

**Epidemiology of measles and rubella:** Four sporadic confirmed measles cases were detected in 2017, and incidence was 0.14 per million. Three were identified as importations.

No rubella cases were identified in 2017. In last five years, the incidence of rubella steadily declined from 3.5 to 0 per million population, 13% of 54 rubella cases were imported, and 52% were lab confirmed. Four cases were below the age of the first dose, and 53% were unvaccinated or of unknown status.

**Quality of measles and rubella surveillance:** All indicator targets were met for 2017, except a low discarded non-measles non-rubella rate of 0.15 per 100 000 population. Some surveillance data were only presented in aggregate for 2013–2017, making it difficult to assess progress.

There was a low rate of laboratory confirmation for rubella (52%) in 2013–2016.
CRS has been notifiable since 2008, and reported cases are to be immediately and thoroughly investigated with sampling and lab testing. No CRS cases have been reported since 2012, with apparently well-functioning CRS surveillance. The last four CRS cases reported (2008 and 2012) were born outside of Hong Kong SAR (China) to mothers with unknown vaccination status.

**Measles and rubella population immunity:** There are high vaccination coverage rates of over 95% for MMR vaccine among primary 1 and 6 students for both doses. Serosurveys conducted in 2011-2014 indicate a seroprevalence rate at least 95% across all age groups. The Department of Health has increased efforts to address vaccination gaps and improve disease awareness among high-risk population groups. There is a long history of rubella vaccination among adolescent females and women of childbearing age. There have been high coverage rates of over 95% for the two doses of MMR vaccine among primary 1 and 6 students since 2008 and similarly high rates of MMR1 of over 98% since 1995 (people now 22 years of age) through immunization surveys every 2–3 years.

Population-based serological surveys have been conducted every year since 2004 from patients in hospitals and clinics submitted for routine and diagnostic tests. The measles seroprevalence rate has been maintained at 80% or higher in all age groups except males aged 39–51 years (born between 1966 and 1978) and females older than 49 years (born before 1968), where seroprevalence is about 75%.

Rubella seroprevalence rates among pregnant women are 82–97%. RCV coverage is 80–90%, especially among those younger than 25 years, which may reflect immigration, increasing the proportion of women born outside of the area.

**Programme sustainability:** National outbreak preparedness and response plans were updated in 2016 and finalized in 2017. The Government provides full funding support for two doses of MR vaccine. A multi-year plan of action exists to continually achieve and maintain measles and rubella elimination.

**Genotype evidence:** No measles outbreaks and no rubella cases were reported. A total of 14 rubella samples from 2013 to 2016 were successfully genotyped as 1E and 2B.

### 2.7.6 Japan

**Epidemiology of measles and rubella:** In 2017, 183 measles cases were identified and only 13 had unknown source of infection; all others were imported cases. In 2017, 74 rubella cases were identified with 14 cases being classified as imported or import related. CRS cases were reported in 2012, 2013 and 2014 (4, 32 and 9, respectively), and none in 2015–2017.

**Quality of measles and rubella surveillance:** Reporting of suspected cases is not done systematically and standard surveillance performance indicators are not monitored. The overall number of immunoglobulin M (IgM) tests conducted is used as a basis for calculation of performance indicators at the national level. However, especially for rubella, a large number of IgM tests are conducted as screening and do not provide a meaningful indication of measles and rubella surveillance sensitivity. Investigation of suspected cases is of high quality (i.e. able to determine source of infection for a high proportion of cases), as is outbreak investigation. CRS is a notifiable disease and must be reported within seven days; both clinical and laboratory criteria are used.

**Measles and rubella population immunity:** Japan achieved very high MRCV1 and MRCV2 coverage. Specific efforts are ongoing to improve performance of prefectures with less than 90% MRCV2 coverage.

**Programme sustainability:** Japan has continued its commitment towards measles and rubella elimination.

**Genotype evidence:** Despite large number of cases, compelling genotype evidence is available to prove the absence of endemic circulation of measles, including detailed named-strain data.

### 2.7.7 Lao People’s Democratic Republic

**Epidemiology of measles and rubella:** Measles incidence has been declining since 2014, with only three cases identified in 2017 from two provinces. Cases continue to be among children under 5 years
of age of the Hmong ethnic population. Rubella cases are also declining, with 10 cases identified in 2017.

**Quality of measles and rubella surveillance:** Measles and rubella surveillance is fully integrated as AFR surveillance. Surveillance performance indicators were met at the national level, except the proportion of specimens received by a laboratory within five days (69%). At the subnational level, surveillance performance continues to be variable, and the proportion of sample collection in northern provinces needs improvement. There are continued efforts to improve surveillance and two VPD surveillance reviews were conducted in 2015 and 2017. No CRS system is in place yet.

**Measles and rubella population immunity:** MRCV1 coverage increased from 76% in 2016 to 82% in 2017. Nine of 17 provinces have coverage over 80%, and there is significant variability in coverage at the district level (74 districts reported coverage over 80%, 66 reported coverage between 50% and 80%, and eight reported coverage below 50%). The second dose of MRCV was introduced in 2017 with a SIA targeting children 9–59 months old and achieving 99% coverage. Immunization service delivery relies heavily on outreach vaccination. Intensified outreach sessions occur for ethnic minority and hard-to-reach populations, at least four times per year.

**Programme sustainability:** The Lao People’s Democratic Republic is fully committed and have developed a draft plan of action for measles and rubella elimination. The Government recently passed a national immunization law, and government financial investment for VPD control has been increasing.

**Genotype evidence:** The National Center for Laboratory and Epidemiology is accredited as a WHO measles laboratory but does not have genotype capacity yet. Samples are sent to the Regional Reference Laboratory in Hong Kong SAR (China). All measles genotypes were H1 from 2010 to 2015.

### 2.7.8 Macao SAR (China)

**Epidemiology of measles and rubella:** In 2017, two measles cases were identified in a single extended family, both under the age of 12 months and below the recommended age of the first MCV dose. No rubella cases were detected. The last major rubella outbreak was in 1989/1990; the last rubella case was identified in late 2016.

**Quality of measles and rubella surveillance:** The non-measles discard rate was 2.4 per 100 000 population in 2017. All cases had adequate investigations with adequate specimen collection and were laboratory confirmed.

CRS has been notifiable since 1999, and CRS surveillance is conducted by both hospitals with an obstetrics-gynaecology department in the country. Since 1993, there is also a Congenital Malformation Monitoring System that serves as supplementary surveillance for CRS. One confirmed CRS case was reported in 2001; no information is provided on how many suspected CRS cases were reported through the systems.

**Measles and rubella population immunity:** There has been a long and effective measles vaccination programme. The current coverage for MRCV is reported to be higher than 95% for both doses, among the birth cohort of usual residents. In 2017, a temporary outbreak immunization “zero dose” for infants 9–11 months old was implemented. School vaccination checks are conducted at pre-primary, primary and secondary schools, which require the reporting of any vaccine refusal to the Macao Centre for Disease Control and Prevention for follow-up (in 2017, 27 documented refusals for MRCV).

**Programme sustainability:** The immunization programme has the full support and backing of the Government, which emphasizes prevention, procures all the national immunization programme vaccines, is responsive to transmission threats, and communicates risks to both the medical community and local citizens.

**Genotype evidence:** Both measles cases were identified as D9.
2.7.9 Malaysia

**Epidemiology of measles and rubella:** Measles remains endemic with most cases occurring before 7 years of age. In 2017, 1658 measles cases were reported, with the vast majority being laboratory confirmed, only 25 epi-linked and 10 clinically compatible. Five cases were identified as imported. Over the last five years, states with the highest incidence was reported were Johor, Selangor, Sabah and the federal territory of Kuala Lumpur. In 2017, 115 rubella cases were identified, mostly among children younger than 1 year of age. Rubella cases in older age groups are mainly identified among male cases given the historical vaccination of females. Nine CRS cases were detected in 2016.

**Quality of measles and rubella surveillance:** Measles has been notifiable since 1988, with laboratory confirmation introduced in 2004; rubella became nationally notifiable in 2010. Measles and rubella cases are reported via an online system (Measles Investigation Information System SM2). Measles surveillance performance has been consistently high and improving in the last decade, at both national and subnational levels. Information on vaccination status of cases improved from over 90% cases with unknown vaccination history in 2010 to 5% in 2017. Although individual case investigation is excellent, investigation of clusters/outbreak is suboptimal, as suggested by the disproportionate number of laboratory-confirmed versus epi-linked cases and that in 2017, 115 measles outbreaks were reported, with only 10 having over 10 cases, mostly described as household clusters. Starting from 1 January 2018, suspected CRS is notifiable. Previously, CRS cases were identified by retrospective hospital admission record review.

**Measles and rubella population immunity:** National coverage for both doses of MRCV is over 95%. At the subnational level, coverage is not homogeneous; in 2017, 41% of districts reported MRCV1 coverage lower than 90%. A national coverage survey found 86% coverage MCV1 by card and 95% coverage by card and recall in the 2015 birth cohort. Quality of coverage monitoring is made difficult because of the challenge to determine the target population (denominator). In 2016, the schedule for MRCV1 and MRCV2 was set to 9 and 12 months. The school vaccination programme for the second dose before 2016 appeared to be working well, and it is still used for birth cohorts targeted before change of MRCV schedule.

**Programme sustainability:** The Government provides strong support towards measles and rubella elimination, with dedicated funding for training and consumables. However, SIA funds must come from the state or district.

**Genotype evidence:** Genotyping information is available for a significant number of cases. Several genotypes are circulating in Malaysia.

2.7.10 Mongolia

**Epidemiology of measles and rubella:** After the large outbreak in 2015–2017 with a total of 50,981 cases, only nine cases were reported in 2017 with the majority under the age of 1 and eight cases from Ulaanbaatar city. Measles is now under control, and the large epidemic unquestionably has increased population immunity to the measles virus. There have been 13 laboratory-confirmed cases of rubella in 2017.

**Quality of measles and rubella surveillance:** Surveillance performance in 2017 met all targets except for sensitivity at second-level administrative units; only 14% of provinces reported the target discard rate. However, many provinces have very small populations and are not expected to meet this target.

Rubella surveillance is included in integrated AFR surveillance with parallel measles/rubella testing. Pilot CRS surveillance was established in 2010 but not continued.

**Measles and rubella population immunity:** MMR vaccine coverage has been high, which may indicate that the vaccine targeted age group is well protected against rubella. A nationwide serological survey conducted in 2016 showed wide immunity across all age groups, with a small gap among adolescents not covered by the 2016 adult campaign.
In 2016, a serosurvey indicated a rubella immunity gap among those 2–7 years old in Western Provinces, most likely due to use of measles-only vaccine in a 2015 campaign for those under 5 years of age.

**Programme sustainability:** MMR vaccine is fully funded by the national immunization programme. Mongolia is finalizing its national strategic plan, national outbreak preparedness and response plan, and standard operating procedures for measles and rubella surveillance.

**Genotype evidence:** Genotyping was not done in 2017. It is encouraged to perform genotyping even when the number of cases is small. To confirm interruption of transmission and to verify elimination status, genotype evidence must be obtained including “named strains” to identify genetic variants that will support interruption of endemic measles.

### 2.7.11 New Zealand

**Epidemiology of measles and rubella:** Measles epidemiology has been lower in 2018 than in the previous year. Case investigation has linked 93% of the 14 cases to known importations.

In 2017, there was a single unvaccinated, laboratory-confirmed rubella case, imported from the Philippines. The last identified CRS case was in 1998.

**Quality of measles and rubella surveillance:** Most indicators have been met, particularly the suspected case investigation rate is reassuring. There was good documentation obtaining genotype information for all measles outbreaks and two of four sporadic cases, and for the single rubella case.

Measles and rubella have been notifiable since 1996 and are reported through the EpiSurv system from a variety of reporting sources. Case definitions are mostly aligned with WHO, although AFR is not used as standard suspected case definition. All performance indicators met or surpassed targets, as per data reported in the NVC report. Data submitted to the WHO Regional Office are insufficient to calculate standard performance indicators and the calculated discard rate is 0.4 per 100 000 population. In 2017 and January to June 2018, over 90% of cases were classified by source of infection.

CRS surveillance is conducted through the New Zealand Paediatric Surveillance Unit, starting January 1998. The surveillance methodology is based on that of the British Paediatric Surveillance Unit used for monitoring of rare conditions. Paediatricians are invited annually to join the Paediatric Surveillance Unit (98% acceptance in 2012) and provide monthly solicited case reporting. There was an 88% monthly response rate in 2017. Case responses are cross-checked with other health data sources.

**Measles and rubella population immunity:** The country has detailed information on population immunity estimates. Strategies to address known immunity gaps of 10% in specific populations are under discussion.

Current immunity levels appear to allow infrequent outbreaks of moderate size, based on modelling. Known immunity gaps are increasing in age, 90% of locally acquired cases were aged over 15 years in 2017. Strategies to address these age groups are recognized to be costly and uptake challenging. The country reports slightly lower coverage in Maori and “other” ethnicities. Disparity by socioeconomic status appears to be minimal by way of monitoring vaccination by deprivation, meeting the needs of their community and raising the coverage in more deprived areas.

**Programme sustainability:** The country provides free vaccine for all children and adults without immunity or without two documented doses. In addition, it has demonstrated initiative to address known challenges for measles immunity.

**Genotype evidence:** All outbreaks of measles had an associated genotype. Three sporadic cases (21%) did not have an associated genotype. All detected genotypes in 2017 were D8, associated with a single named strain, Oskaka JPN29.5 ex IDN, but with four demonstrated importations.

The imported rubella case was genotype 2B.
2.7.12 Pacific island countries and areas (PICs)

**Epidemiology of measles and rubella:** The incidence of measles and rubella has been relatively low in the last three years. Only 22 measles case have been reported since 2015.

**Quality of measles and rubella surveillance:** Hospital-based active surveillance (61 hospitals and 200 clinicians in 21 PICs) reporting from the most populated countries (Fiji and Solomon Islands) is regular, timely and complete. Performance indicators are improving over time in the subregion as a whole, though surveillance is uneven and needs to be improved in most countries. Only two countries report discard rates. Access to laboratory testing is also highly variable.

**Measles and rubella population immunity:** All countries include a second dose of MCV in the routine programme, except for Vanuatu; Solomon Islands introduced MCV2 in 2018. RCV has been introduced in all PICs, most recently in Solomon Islands (2013) and Vanuatu (2015). Estimated MCV1 coverage ranges widely among the PICs, with lowest coverage in Samoa and Vanuatu (53%).

**Programme sustainability:** Nine PICs have school immunization laws requiring MCV prior to school entry. Generally, there is strong governmental commitment to national immunization programmes in the PICs, and external funding support for many countries is available. Most countries have not completed risk assessments or outbreak preparedness and response plans. The 2017 SRVC meeting recommended developing a subregional plan of action to achieve measles and rubella elimination.

**Genotype evidence:** Limited virus isolates have been genotyped. Cases from the 2014 outbreak in the Federated States of Micronesia and Solomon Islands were all B3.

2.7.13 Papua New Guinea

**Epidemiology of measles and rubella:** Following measles outbreaks in 2013–2015, there were measles outbreaks in East Sepik province in 2017 and West Province in 2018. The number of cases reported to the National Health Information System and National Surveillance Unit still need to be harmonized. The country’s measles situation is characterized by large epidemics separated by moderate-sized epidemics for a relatively long time and predominance of cases among vaccination target age groups, which is typical for a measles epidemic under poor vaccine control.

**Quality of measles and rubella surveillance:** A small number of suspected cases was investigated: 49 of 3469 in 2017 and 51 of 1843 in 2018. Though some of the surveillance and laboratory indicators have reached their targets, it is difficult to assess the quality of surveillance because of the dual reporting system.

**Measles and rubella population immunity:** In 2016 and 2017, more than 50% of the country’s districts had MCV1 coverage of less than 50%. Coverage continued to deteriorate despite efforts and resources given to improve immunization services. Implementation of SIREP-Plus, or the Special Integrated Routine Expanded Programme (EPI) on Immunization Strengthening Programme, has been ongoing since 2015 in 20 out 22 provinces but has not been effective in increasing MR vaccine coverage. Overall coverage was 60%, 51% and 47% in 2015, 2016 and 2017, respectively. Additional challenges exist in cold chain management, with lack of adequate stock registry and issues with vaccine wastage and vaccine dilution.

**Programme sustainability:** With the decentralized health system structure, provincial governments determine the allocation of funds into provincial priority programmes. Programme sustainability is doubtful as the National Department of Health has no legitimate authority over the funding and the national immunization programme has no role to play on how immunization activities are funded and run in the provinces, frequently not of high priority in some provinces.

**Genotype evidence:** Genotype B3 was identified in the East Sepik outbreak in 2017. No genotype was reported for outbreak strains in 2018.

2.7.14 Philippines

**Epidemiology of measles and rubella:** In 2017, there were 4585 suspected measles–rubella cases, including 791 classified as measles (laboratory or epi linked) and four deaths. The measles incidence
rate was 1.2 per 100,000 population in 2017, but has been increasing with 1,147 cases in the first four months in 2018. Measles cases were concentrated in children under 1 year of age (36%) and 1–4 years of age (39%). Confirmed cases were reported from all 17 regions.

Of 4,585 suspected measles–rubella cases, 474 were confirmed as rubella, from all 17 regions in 2017. Rubella incidence has been stable for the last six years. Rubella cases were highly concentrated in young adults of peak childbearing age (65% were aged 15–29 years).

**Quality of measles and rubella surveillance:** Surveillance indicators continue to be poor; only timeliness of reporting was met in 2017. Laboratory specimen tracking and timeliness are not consistent. The national measles laboratory has been WHO accredited since 2008, but it requests subnational labs to help with load and timeliness.

Parallel IgM testing of measles and rubella began in 2016. The Epidemiology Bureau began monitoring pregnant women who tested positive for rubella IgM or who were exposed to rubella, strengthening coordination and reporting of private hospitals. There is no CRS surveillance, but a retrospective study in 2015 estimated 162–373 annual CRS cases.

**Measles and rubella population immunity:** In 2016 and 2017, MRCV1 (down to 70% in 2017) and MRCV2 (down to 62% in 2017) coverage has continued to decline compared to 2015. The school-based immunization programme for grade 1 selective and grade 7 non-selective vaccination catch-up (about 74% of birth cohort registered) has been implemented with variable success by province and city. A growing measles immunity gap exists among children born since the last nationwide SIA in 2015. The age distribution of rubella cases shows higher immunity among children younger than 14 years, but clear susceptibility in those aged 15–29 years.

The Philippines has adopted a shift from nationwide synchronized vaccination campaigns to subnational SIAs using a high-risk approach. Subnational SIAs were conducted in Mindanao and the National Capital Region in early 2018 and are planned for other areas later in the year. Coverage of these campaigns was highly variable.

**Programme sustainability:** The Department of Health updated its Comprehensive Multi-Year Plan (cMYP) for its National Immunization Program covering 2016–2022 and includes a wide range of recommended actions to support measles elimination, including Reaching Every Purok (REP) Strategy as a way of raising immunization coverage for children under 2 years of age through routine immunization activities, as well as school-based immunization providing MCV for grade 1 children (aged 6-7 years) and grade 2 children (aged 13 years). However, sustainability is highly threatened by variable implementation success of all initiatives, and recent stress on public confidence and demand for immunization following highly publicized adverse events following introduction of dengue vaccine.

**Genotype evidence:** Rates of genotyping of measles and rubella both improved in 2017: 23 measles isolates were genotyped, all B3, as were 28 rubella isolates, all 2B.

### 2.7.15 Republic of Korea

**Epidemiology of measles and rubella:** In 2017, there were five confirmed measles cases and two clinically compatible cases without laboratory or epidemiological evidence. Three of the confirmed cases met the criteria for importation (Thailand, Viet Nam, Myanmar), while two were from an unknown source and not linked by place or time to other cases. In 2017, there were three confirmed rubella cases and four clinically compatible cases without laboratory or epidemiological evidence. There were no secondary cases or larger outbreaks. The cases were sporadically distributed in time and space. CRS was diagnosed in one child (genotype 2B) whose mother was diagnosed clinically with rubella in Viet Nam.

**Quality of measles and rubella surveillance:** Most measles surveillance indicators have been met following 2017 RVC recommendations, including timely case reporting and investigation. However, the discard rate has not been met nationally nor in any province. Indicators for the discard rate at national and subnational levels are low (0.6 and 0.3 per 100,000 population for measles and rubella, respectively; none of the subnational units met the target). This could be explained by the lack of
sensitive suspected case definition. However, this is supplemented with alternative diagnostic and reporting algorithms. All other performance indicators are meeting or surpassing targets. The Republic of Korea’s rubella and CRS surveillance system began in 2000 as a mandatory reporting system. One suspected CRS case was found in 2017 but tested negative.

**Measles and rubella population immunity:** Routine vaccination coverage in 2017 with two doses of MRCV remains above 96% for both doses. The school entry screening (through school entry requirement) confirms high national coverage exceeding 98%. No specific communities with immunity gaps are noted in the NVC report.

The planned 2018 national MMR serosurvey for people aged 1–50 years will provide useful data on current levels of immunity.

**Programme sustainability:** There is a fully funded immunization programme with free MMR for all children 0–12 years in the Republic of Korea. The programme has achieved interruption of measles and rubella virus circulation, and there is strong political commitment to maintaining elimination.

**Genotype evidence:** Genotyping was only performed on one imported measles case (D8 importation from Viet Nam) and on one imported rubella case (2B importation from Viet Nam).

### 2.7.16 Singapore

**Epidemiology of measles and rubella:** Singapore as a major international transit centre has a unique situation where the importation rate could be very high. In 2017, 68 measles cases were reported with a relative incidence of 11 per million population. Measles cases are most frequent in children younger than 10 years old and in adults over 20 years of age – over 54% of all cases. Cases among the younger group were in children who did not have two doses of vaccine. Among Singaporean residents, the Malay community had the highest incidence.

In 2017, 15 rubella cases were reported, with incidence of 2 per million. Cases were mostly between 25–34 years of age, with a few both in older and younger groups where age vaccination status was either negative or unknown. Rubella cases were most common in residents who were not of the three main ethnic groups. Seven laboratory positive but asymptomatic cases were discarded.

**Quality of measles and rubella surveillance:** Approximately two thirds of measles cases reported a genotype result, but no strain identification was included; 29% of measles cases identified a country of importation. Measles and rubella have been legally notifiable diseases since 1990. Parallel testing has been implemented since 2012 with enhanced surveillance and investigation of clinically compatible cases. The rubella clinical case definition includes all cases with fever and maculopapular rash. In 2017 and previous years, the proportion of cases with adequate investigation surpassed the target and indicator for adequate specimen collection. Only one third of rubella cases had adequate samples for genotyping and had available sequence data; 46% of cases identified a country of importation. Cases are discarded if they are lab negative or lab positive but do not fit a case definition. A registry for pregnant women with rubella infection is used; follow-up includes testing of the infant for rubella infection and CRS.

**Measles and rubella population immunity:** Recent vaccination coverage has been high. While the uptake of the second dose in the second year of life is low, the country has instituted two systematic checks and reminders to increase coverage. By 7 years of age, coverage of the first dose increased by to 97% (an average improvement of 2%) and the second dose to around 93% (an average improvement of 3%). The rubella serological surveys suggest that most of the population has rubella immunity in excess of 80%, with those born since the mid-1970s having in excess of 90% seropositivity.

**Programme sustainability:** There are good provisions for the immunization options for Singaporean nationals. The options, recommendations and guidelines regarding the policies for non-citizen residents are unclear. There has been a vaccination recommendation for adults since November 2017. The Ministry of Health commenced a new initiative in 2018 for post-exposure prophylaxis for several groups: infants at high risk, pregnant unvaccinated women, or those who did not complete two doses of MMR and are immunocompromised.
**Genotype evidence:** Enhanced laboratory surveillance resulted in genotype information for two thirds of cases. Genotyping was not performed on 25 cases, of which 19 were unknown and six were imported. Measles reported three genotypes: mostly D8 and D9 and only one H1—imported. Detailed analysis of measles strain lineage demonstrated multiple importations of clusters with different lineages.

Rubella genotypes 1E and 2B were identified.

### 2.7.17 Viet Nam

**Epidemiology of measles and rubella:** Viet Nam has reported an increasing incidence of measles cases beginning in late 2017. In 2016, there were only 46 cases (lowest recorded incidence); in 2017, there were and 214 cases (0.22 per 100,000 population), in 27 provinces, almost all in Northern provinces. In the past year, most cases were in the southern region. Most cases were among infants (60%) and those aged 1–4 years. Incidence is low among the age group 5–19 years, who were covered by a previous SIA in 2014–2015.

**Quality of measles and rubella surveillance:** In 2017, all outbreaks (100%) had been confirmed with serological testing and swab specimens, and 87% of suspected cases were investigated. However, only 70% of suspected cases had adequate blood specimens (61% if including suspected cases that were not investigated). The surveillance sensitivity indicator was met nationally, but was only met by 35 of 63 provinces subnationally.

An EPI surveillance review was conducted in 2017, which found many opportunities for strengthening. There were concerns with the ability to detect and respond to outbreaks quickly, and poor linkage between curative and public health sectors.

Measles surveillance has been case based since 2002 and was recently included in an integrated system for communicable disease surveillance (suspected cases not systematically reported). In 2017, Viet Nam conducted a VPD surveillance review, which showed a need for improved collaboration between curative and preventive sectors for case reporting and investigation, as well as a need for training and adequate allocation of resources. Collection and testing of specimens for genotyping improved in 2017. CRS surveillance is established in three national hospitals; 18 cases were detected in 2016 and 19 in 2017 (509 suspected CRS cases were tested in 2017).

**Measles and rubella population immunity:** Routine immunization and the largest nationwide MR campaign in 2014–2015 have affected the current immunization status significantly. In 2016, Viet Nam conducted the MR school-based campaign for adolescents aged 6–17 years, covering 1,787,588 students (94.9% of the total target group). There was no measles SIA in 2017. Results show a slight reduction in routine MCV1 and MCV2 coverage in 2017. The NVC report repeatedly indicates its inherent concern for the under-reached population group in mountainous territories, 42.5% in number of communes (4734 of 11,121) and the resulting discrepancy among provinces. At the Technical Advisory Group meeting, under-accessible target groups due to rapid urbanization were discussed also.

**Programme sustainability:** The leadership structure and responsibility for measles elimination continues to be solid, proven by the successful and memorable implementation of the largest nationwide MR campaign in 2014–2015. Policy commitment of the Government and the Ministry of Health is represented in the five-year EPI plan for 2016–2020. Viet Nam has committed to the Eliminate Measles and Rubella Initiative, a global partnership to ensure that no child dies from measles or is born with CRS.

Government expenditure for EPI has gradually increased over the years, about 10% each year. From 2017, a new decision by the Government stated that vaccines would be secured by central government budget, while local government would be responsible for operational costs of all health programmes. EPI has been conducting training workshops for provincial preventive medicine centres on making plans to advocate local governments for investment for EPI.

**Genotype evidence:** In 2017, 52 swabs and 11 urine specimens were taken, and 11 strains were identified in the northern region. All strains were D8 genotype, which shared the highest 100%
nucleotide identity with the Japanese D8 strain and the strains detected previously in the south of Viet Nam. This was the first time that genotype H1 was not identified.

3. CONCLUSIONS AND RECOMMENDATIONS

3.1 Conclusions

3.1.1 Australia

• The RVC verifies that Australia has sustained the interruption of endemic measles virus transmission, and notes that the immunization programme has been even further strengthened since achieving elimination.

• The RVC verifies that Australia has achieved the interruption of endemic rubella virus transmission.

• The RVC congratulates Australia for a quality report, with thoughtfully presented evidence of high-quality surveillance, and rapid and thorough outbreak response and case investigation, including determination of source of infection in a high proportion of cases.

• The RVC acknowledges Australia’s high level of political commitment to sustaining the national MR elimination programme.

• The RVC supports Australia’s use of PCR negatives in addition to serology when determining discarded non-rubella rates.

3.1.2 Brunei Darussalam

• The RVC verifies that Brunei Darussalam has sustained the interruption of endemic measles virus transmission.

• The RVC concludes that Brunei Darussalam’s high population immunity against rubella is adequate to prevent sustained endemic transmission, and that surveillance is adequate to detect a large rubella outbreak, and thus verifies elimination of rubella.

• However, the RVC notes that existing surveillance may be inadequate to ensure that rubella verification status is maintained. A well-functioning CRS surveillance system is needed to reduce risks of infection transmission from an undetected CRS case, and would complement rubella surveillance as a high proportion of rubella cases are asymptomatic.

3.1.3 Cambodia

• The RVC verifies that Cambodia has sustained the interruption of endemic measles virus transmission.

• The RVC appreciates the effort made by Cambodia to respond to RVC recommendations on strengthening the country’s capacity to sustain measles elimination and achieve rubella elimination.

• The RVC notes that the MR cases in 2017 were detected almost exclusively among young children, suggesting a possible weakness of surveillance sensitivity for adult cases, as adults are the most likely source of importation and infection.

3.1.4 China

• The RVC congratulates China on achieving a historic low MR incidence in 2017.

• The RVC notes the continued subnational variability in immunization coverage and measles epidemiology across provinces of China.

• The RVC congratulates China on the high proportion of laboratory-confirmed cases.
• The RVC notes with concern that the immunity profile and epidemiology of rubella in China suggests a looming CRS crisis, unless urgent efforts are taken to improve immunity among young adults and adolescents.

• The RVC notes the innovative use of a third-dose strategy in high-density areas and would welcome further details on the basis for and impact of this approach.

3.1.5 Hong Kong SAR (China)
• The RVC verifies that Hong Kong SAR (China) has sustained the interruption of endemic measles virus transmission.

• The RVC concludes that Hong Kong SAR (China) may have already achieved interruption of endemic rubella virus transmission, and would welcome a detailed report along the five lines of evidence, once the NVC has determined that evidence supports the elimination criteria.

• The RVC congratulates Hong Kong SAR (China) on sustaining a low incidence of measles and rubella despite high traffic of international visitors and temporary workers.

3.1.6 Japan
• The RVC verifies that Japan has sustained the interruption of endemic measles virus transmission.

• The RVC appreciates that Japan provided detailed descriptions of the specific actions taken in response to RVC recommendations.

• The RVC notes that Ministry of Health, Labour and Welfare has established a national plan targeting rubella elimination by 2020 and that there has been progress towards elimination.

• The RVC congratulates Japan on the high quality of case and outbreak investigations, and the detailed genotyping data on measles cases, which is crucial for demonstrating sustained elimination in the Japanese setting.

• The RVC notes with appreciation the NVC’s active role in advocacy through publication of lessons learnt from recent outbreaks, and editorial commentary on the importance of maintaining a strong immunization programme in Japan.

3.1.7 Lao People’s Democratic Republic
• The RVC notes and congratulates the Lao People’s Democratic Republic on its substantial recent effort to strengthen MR elimination programmes, including a VPD surveillance review and full EPI review.

• The RVC notes the high coverage achieved during the recent nationwide SIA.

• The RVC congratulates the Lao People's Democratic Republic on the passage of an ambitious and comprehensive immunization law, and for developing a new national plan of action for MR elimination.

• The RVC notes the implementation of school-based immunization checks to improve coverage among young children.

• The RVC is pleased to see declining case counts with sporadic outbreaks, despite improvements in surveillance. This reflects the increasing population immunity achieved through routine and supplemental immunization.

3.1.8 Macao SAR (China)
• The RVC verifies that Macao SAR (China) has sustained the interruption of endemic measles virus transmission.
• The RVC verifies that Macao SAR (China) has achieved the interruption of endemic rubella virus transmission.
• The RVC appreciates that Macao SAR (China) provided detailed descriptions of the specific actions taken in response to RVC recommendations.
• The RVC notes that the case definition used for CRS surveillance may be more specific than internationally recommended standards, and thus CRS cases could potentially be missed.

3.1.9 Malaysia
• The RVC congratulates Malaysia on achieving high reported coverage of measles-containing vaccine (MCV) nationally; but notes that several states have coverage below 80%, and there remains a large population that lives in districts with coverage below 70%.
• The RVC notes the recent increase in measles cases despite the significant decline in MR incidence over previous years.
• The RVC notes the relatively high rate of measles among unvaccinated school-aged children, and is encouraged by Malaysia’s recent implementation of a school-based vaccination check, especially given the high national rates of school attendance.
• The RVC congratulates Malaysia on the exceptionally high performance of surveillance and laboratory indicators at both a national and subnational level, with a high rate of epidemiologically-linked and laboratory-confirmed cases.
• The RVC notes that different denominators are used to calculate vaccination coverage, which creates uncertainty in estimating population immunity.

3.1.10 Mongolia
• The RVC congratulates Mongolia on achieving a low level of measles transmission, with only nine confirmed cases among the large number of laboratory-investigated suspected cases.
• The RVC acknowledges the intensive effort made by Mongolia since the 2014–2015 outbreak to strengthen the MR programme, including a comprehensive review of the immunization programme and the cold chain system, conducting a high-quality representative nationwide serological survey, and implementing an electronic immunization registry.
• The RVC notes that the 2016 serological survey indicates high MR population immunity across a wide age range, except for some gaps among school-aged children and a specific pocket of rubella susceptibility among young children in western provinces. The high immunity observed among children aged 12–23 months, born after the SIA and during a period of low transmission, demonstrates the effectiveness of the routine immunization programme to reach the population.

3.1.11 New Zealand
• The RVC verifies that New Zealand has sustained the elimination of endemic MR transmission.
• The RVC congratulates New Zealand on the Measles and Rubella Symposium held in October 2017, which identified novel strategies to sustain MR elimination in New Zealand by improving immunity among specific ethnic groups and young adults.
• The RVC appreciates the thorough epidemiological and genotypic analysis in New Zealand’s report, which clearly demonstrates the independence of importation events.
3.1.12 Pacific island countries and areas

- The RVC endorses the conclusions of the SRVC, and notes the progress made towards strengthening the MR programmes and achieving low rates of measles and rubella in certain countries in recent years.
- The RVC congratulates Solomon Islands on having introduced a second dose of MRCV and notes the planned MR SIA in 2019.
- The RVC notes that rubella is not yet a notifiable disease in Vanuatu, New Caledonia, Kiribati and Cook Islands.
- The RVC notes that there are large MR immunity gaps and variable surveillance quality among the PICs, including in countries with larger populations.
- The RVC notes the mass vaccination campaigns conducted in Fiji and Samoa in 2017.

3.1.13 Papua New Guinea

- The RVC notes with concern the declining coverage of MRCV in Papua New Guinea, which may be further compromised by the ongoing efforts to contain the circulating vaccine-derived poliovirus (cVDPV) outbreak.
- The RVC warns of the likelihood of a large nationwide outbreak, unless there is an urgent immunization intervention and marked improvements in surveillance and routine immunization coverage.

3.1.14 Philippines

- The RVC expresses its disappointment at the very late submission of the Philippines annual report.
- The RVC notes the increasing incidence of measles since the last outbreak, extending into 2018, with widespread involvement throughout the country.
- The RVC notes ongoing rubella circulation over the last six years across all regions, with the highest attack rate among young adults, including females of childbearing age, leading to a high risk of CRS cases.
- The RVC notes that although the Philippines lacks routine CRS surveillance, a retrospective study suggests a large unreported burden of CRS in the country.
- The RVC appreciates that a second rubella-containing vaccine dose was introduced in 2017, but notes a disturbing decline in coverage of both doses of MRCV in recent years, with coverage currently too low to prevent sustained MR transmission and CRS cases.
- The RVC appreciates the Philippines’ stated commitment to strengthen routine immunization.
- The RVC notes that the current strategy of small-scale outbreak response is inadequate to slow the rapid accumulation of susceptible children and growing risk for large sustained outbreaks.
- The RVC alerts the Philippines that all epidemiological and coverage data suggest that the country is on the brink of a huge MR outbreak, with likely many measles deaths in children and cases of CRS. Based on the experience of the 2014 B3 outbreak, this would not only have devastating effects in the Philippines but also challenge other countries in the Region and the world working towards MR elimination.

3.1.15 Republic of Korea

- The RVC verifies that the Republic of Korea has sustained the elimination of endemic MR transmission.
The RVC notes that despite several imported cases, there were no secondary cases of measles or rubella.

3.1.16 Singapore

- The RVC appreciates Singapore’s efforts to provide detailed and quality analysis of the molecular epidemiology of measles, which demonstrates multiple importations of cases with different genotype lineages, suggesting high-quality laboratory surveillance and demonstrates patterns consistent with measles elimination. The RVC therefore verifies that Singapore has achieved measles elimination.
- The RVC notes that Singapore faced significant challenges in demonstrating elimination in the setting of high population density and multiple measles importations from international travellers and workers, and notes that without the high-quality molecular epidemiology analysis presented to the RVC, the high rate of unknown source cases would be an obstacle to distinguishing multiple importations from periods of sustained transmission.
- The RVC congratulates Singapore on achieving high population immunity to measles and rubella demonstrated by serological survey, especially among older age groups, but notes that there is lower measles population immunity among young adults.
- The RVC congratulates Singapore on the high rate of virological sample collection, and encourages Singapore to maintain this high rate of viral isolation to help demonstrate the independence of cases related to multiple importation events.

3.1.17 Viet Nam

- The RVC acknowledges the encouraging decline in MR incidence, but notes that the occurrence of small-scale outbreaks in localized high-risk geographic areas, predominantly affecting infants and young children, raises concern of inadequate surveillance to detect sporadic cases among adults.
- The RVC notes the under-reached populations in specific areas such as mountain territories and urban environments.
- The RVC notes the VPD surveillance review and consultation on a new plan of action.
- The RVC notes the shift from nationwide to subnational risk-targeted campaigns.
- The RVC notes the improvement in the rate of genotyping from detected measles cases.
- The RVC notes that only the D8 genotype was detected, and that no genotypes were available from the south of the country.
- The RVC notes that there are different sources of VPD reporting with inconsistent data, which creates challenges for the RVC in evaluating epidemiological evidence for surveillance.

3.2 Recommendations

3.2.1 Recommendations for Member States

Australia

1. Australia’s confidentiality concern about submitting detailed line lists and spot maps for each outbreak is noted. If Australia continues to provide quality outbreak descriptions, with summary national/state map(s) showing all outbreaks, this should suffice in future years, unless further details are required to understand the epidemiology of a prolonged outbreak.
2. The RVC recommends that countries that have achieved elimination continue to obtain genotype information from all cases of measles and rubella, even sporadic cases. The genotype information should be supplied to the WHO global sequence databases. Genotype
information from imported cases contributes to efforts to monitor regional and global viral transmission patterns.

3. In post-elimination countries, the RVC encourages classification as imported those cases in residents with any international travel history during the infectious period, without epidemiological or genotype evidence of an identified local source after thorough investigation.

4. The RVC requests continued reporting of measles, mumps and rubella vaccine (MMR2) coverage at both 24 and 60 months.

5. The RVC requests that future reports provide the vaccination status of all case patients who are Australian residents, even if the case was imported.

6. The RVC encourages the development of innovative methods for reaching the high-risk group of international travellers, since infection of unvaccinated Australian residents travelling abroad is a potential route of MR importation.

Brunei Darussalam

1. The RVC recommends that the CRS surveillance system be strengthened by making CRS a notifiable disease, and conducting a retrospective case review to provide evidence of the effectiveness of CRS surveillance, and requests that in the next report, Brunei Darussalam describe the surveillance system for CRS and how suspected cases are investigated to confirm or exclude diagnosis.

2. In post-elimination countries, the RVC encourages classification as imported those cases in residents with any international travel history during the infectious period, without epidemiological or genotype evidence of an identified local source after thorough investigation.

3. The RVC requests that Brunei Darussalam include a summary of specific actions taken in response to the most recent RVC recommendations in their next annual report to the RVC.

4. The RVC recommends that countries that have achieved elimination continue to obtain genotype information from all cases of measles and rubella, even sporadic cases. The genotype information should be supplied to the WHO global sequence databases. Genotype information from imported cases contributes to efforts to monitor regional and global viral transmission patterns.

5. The RVC recommends that Brunei Darussalam adopt a combined AFR case definition for suspected measles and rubella, rather than using less sensitive clinical case definitions.

6. The RVC recommends that Brunei Darussalam publish results from its highly effective school entry requirement programme in a peer reviewed journal.

7. The RVC recommends that Brunei Darussalam consider conducting a serological survey to assess the herd immunity of the female population against rubella in the reproductive age group (15–44 years).

8. The RVC requests that Brunei Darussalam provide data on the number of pregnant women tested for rubella, and the proportion seronegative over the last 5–10 years.

9. The RVC encourages Brunei Darussalam to continue to strengthen systems to detect suspected measles cases among foreigners (students and migrant workers), which could give rise to local transmission.

Cambodia

1. The RVC recommends that Cambodia establish a target date for rubella elimination, in line with Regional Committee resolution WPR/RC68.R1 on measles and rubella elimination, and indicate this date in the next annual report to the RVC.

2. The RVC recommends regularly updating the measles risk assessment to allow appropriate targeting of activities to high-risk areas, including areas with significant economic development or with cross-border activity such as Koh Kong, which have a high risk for MR importation; and to special populations, such as temporary residents involved in short-term construction projects, who may be unreached by routine immunization activities and by surveillance.
3. The RVC recommends that countries that have achieved elimination continue to obtain genotype information from all cases of measles and rubella, even sporadic cases. The genotype information should be supplied to the WHO global sequence databases. Genotype information from imported cases contributes to efforts to monitor regional and global viral transmission patterns.

4. The RVC encourages Cambodia to fully implement national guidelines for nosocomial disease control, and recommends that Cambodia increase efforts to conduct detailed case investigation of nosocomial cases, and to conduct post-exposure vaccination of individuals exposed to measles and rubella through hospitalization.

5. In post-elimination countries, the RVC encourages classification as imported those cases in residents with any international travel history during the infectious period, without epidemiological or genotype evidence of an identified local source after thorough investigation.

6. The RVC recommends that Cambodia publish a description of its experience and lessons learnt in achieving, documenting and sustaining elimination of measles in a highly endemic subregion.

7. The RVC encourages Cambodia to collaborate with neighbouring countries to develop and implement synchronized or coordinated surveillance and immunization activities.

China

1. The RVC requests that China include a summary of specific actions taken in response to the most recent RVC recommendations in the next annual report to the RVC.

2. The RVC recommends that China adopt a combined AFR case definition for suspected measles and rubella, rather than using less sensitive clinical case definitions.

3. The RVC recommends that as China approaches elimination, there should be increased efforts to investigate outbreaks to understand chains of transmission, determine the importation status of cases, and use uniform case definitions for outbreaks of measles and rubella.

4. The RVC notes the high proportion of two-dose cases among children aged 5–9 years and encourages China to explore underlying reasons in specific geographic settings with particularly high rates of two-dose cases.

5. The RVC recommends that China strengthen hospital infection control policies to prevent health care-associated MR transmission, as this presents a high risk for infant mortality.

6. The RVC notes the recent decline in subnational surveillance performance compared to the previous year, and encourages China to strengthen surveillance capacity at the subnational level.

7. The RVC recommends that China develop and adopt a CRS surveillance system, which is of particular importance given the relatively large rubella immunity gap among young adults of childbearing age.

8. The RVC recommends that China urgently implement vaccination activities targeting adolescents to fill the immunity gap and reduce the risk of a large CRS outbreak. This intervention will also further advance progress to measles elimination.

9. The RVC fully endorses the China NVC’s recommendation to develop tailored initiatives to achieve elimination that are specific to the challenges and issues in each province, and encourages China to share details and lessons learnt from successful initiatives from provinces that have made substantial progress to elimination.

Hong Kong SAR (China)

1. The RVC recommends that countries and areas that have achieved elimination continue to obtain genotype information from all cases of measles and rubella, even sporadic cases. The genotype information should be supplied to the WHO global sequence databases. Genotype information from imported cases contributes to efforts to monitor regional and global viral transmission patterns.

2. In post-elimination countries and areas, the RVC encourages classification as imported those cases in residents with any international travel history during the infectious period,
without epidemiological or genotype evidence of an identified local source after thorough investigation.

3. The RVC requests that Hong Kong SAR (China) include a summary of specific actions taken in response to the previous RVC recommendations in the next annual report to the RVC.

4. The RVC requests Hong Kong SAR (China) to present further data on the number of suspected CRS cases that were investigated, and discarded as non-CRS.

5. The RVC requests Hong Kong SAR (China) to provide an explanation for the relatively low proportion of laboratory-confirmed rubella cases.

6. The RVC recommends that Hong Kong SAR (China) describe their outbreak preparedness and response plan, which is of particular importance due to high risk of importation, and high risk of hospital-associated transmission.

**Japan**

1. The RVC recommends that Japan continue to maximize laboratory testing of clinically compatible cases.

2. The RVC recommends that given the high rate of PCR testing of suspected cases in Japan, that PCR samples be used to calculate a supplemental discard rate surveillance indicator to describe laboratory testing sensitivity.

3. The RVC recommends that countries that have achieved elimination continue to obtain genotype information from all cases of measles and rubella, even sporadic cases. The genotype information should be supplied to the WHO global sequence databases. Genotype information from imported cases contributes to efforts to monitor regional and global viral transmission patterns.

4. The RVC encourages Japan to continue its focus on improving coverage in areas with MCV coverage below 90%.

5. The RVC requests, that if there are prolonged time periods with multiple cases of a single genotype, Japan provide epidemiological details (such as identification of index cases) in order to distinguish multiple importations of the same genotype from sustained transmission.

6. In post-elimination countries, the RVC encourages classification as imported those cases in residents with any international travel history during the infectious period, without epidemiological or genotype evidence of an identified local source after thorough investigation.

**Lao People’s Democratic Republic**

1. The RVC recommends that the Lao People’s Democratic Republic use every opportunity to vaccinate against measles and rubella and not hesitate to open multi-dose vials.

2. The RVC urges the Lao People’s Democratic Republic to increase efforts to collect virological specimens for genotyping from as many cases as possible.

3. The RVC recommends that the Lao People’s Democratic Republic further strengthen capacity at the district and health centre levels to detect, investigate and respond to outbreaks.

4. Noting the declining rates of endemic cases, the RVC urges the Lao People’s Democratic Republic to conduct careful case investigations to identify the source of importation of outbreaks and sporadic cases.

5. The RVC recommends that the Lao People’s Democratic Republic continue to implement the recommendations of the measles risk assessment conducted in 2016, and the National EPI review conducted in 2014, particularly at the subnational level.

6. The RVC encourages the Lao People’s Democratic Republic to collaborate with neighbouring countries, to develop and implement synchronized or coordinated surveillance and immunization activities.
Macao SAR (China)

1. The RVC recommends using a standardized validated method for serological testing, or validating the chemiluminescent microparticle immunoassay (CIMA), to aid in interpretation of serological survey results.
2. The RVC recommends that countries and areas that have achieved elimination continue to obtain genotype information from all cases of measles and rubella, even sporadic cases. The genotype information should be supplied to the WHO global sequence databases. Genotype information from imported cases contributes to efforts to monitor regional and global viral transmission patterns.
3. In post-elimination countries and areas, the RVC encourages classification as imported those cases in residents with any international travel history during the infectious period, without epidemiological or genotype evidence of an identified local source after thorough investigation.
4. The RVC recommends that Macao SAR (China) publish the results of their many years of annual measles serosurveys as a birth-cohort analysis in a peer-reviewed journal.
5. The RVC recommends that rubella serological screening in pregnancy should include women receiving antenatal care in the private sector.
6. The RVC recommends that Macao SAR (China) identify opportunities to better understand the immunity status of non-resident workers, who represent a high risk of importation of measles and rubella.

Malaysia

1. The RVC requests that Malaysia include a summary of specific actions taken in response to the most recent RVC recommendations in the next annual report to the RVC.
2. The RVC recommends that Malaysia use an assessment of immunization coverage at lower administrative levels to enable risk-targeted immunization activities.
3. The RVC notes that Malaysia's strategy of focal SIAs in high-risk areas has been implemented in a limited fashion with relatively small target populations, and encourages expanded use of targeted supplemental immunization to fill immunity gaps.
4. The RVC encourages Malaysia to work with WHO to develop a plan of action for MR elimination to improve immunity gaps in provinces or districts with historically lower coverage through: (i) strengthening routine immunization; (ii) mass vaccination; and (iii) targeted interventions to populations at high risk of measles introduction, or that may not be easily reached by the successful national strategies that have led to high national MRCV coverage.
5. The RVC encourages Malaysia to continue to conduct high-quality and sensitive virological surveillance to document the genotype of MR cases.
6. The RVC encourages Malaysia to continue to strengthen and monitor the school entry checking programme started in 2017.
7. The RVC recommends that Malaysia continue to strengthen and improve capacity to conduct case and outbreak investigation, to confirm cases by epidemiological linkage, identify chains of transmission and detect contacts.

Mongolia

1. The RVC recommends that Mongolia conduct an analysis and risk assessment to understand the reasons for residual rubella virus susceptibility among young children in western provinces, and close this gap through immunization.
2. The RVC recommends that Mongolia publish the results of its recent serological survey in a peer-reviewed journal.
3. The RVC urges Mongolia to conduct detailed case investigation to identify chains of transmission, and increase efforts to obtain genotype information to support independent importations.
4. The RVC encourages Mongolia to develop and implement CRS surveillance.
5. The RVC recommends that Mongolia establish a target date for rubella elimination, in line with Regional Committee resolution WPR/RC68.R1, and indicate this date in the next annual report to the RVC.

6. The RVC urges Mongolia to increase sensitivity of MR surveillance at the subnational level, and to improve linkage of the Early Warning, Alert and Response Network (EWARN) and VPD surveillance to support rapid identification and investigation of outbreaks.

7. The RVC encourages implementation of school-based programmes to improve immunity among school-aged and adolescent children.

8. The RVC concludes that Mongolia may have re-interrupted endemic transmission of measles, and encourages Mongolia to prepare five lines of evidence documenting the duration of sustained interruption.

New Zealand

1. The RVC endorses the excellent recommendations by the New Zealand NVC, including the recommendation on filling specific immunity gaps to protect against outbreaks of measles and rubella after importation.

2. The RVC recommends that countries that have achieved elimination continue to obtain genotype information from all cases of measles and rubella, even sporadic cases. The genotype information should be supplied to the WHO global sequence databases. Genotype information from imported cases contributes to efforts to monitor regional and global viral transmission patterns.

3. In post-elimination countries, the RVC encourages classification as imported those cases in residents with any international travel history during the infectious period, without epidemiological or genotype evidence of an identified local source after thorough investigation.

4. The RVC further encourages implementation of the recommendations from the Measles and Rubella Symposium to improve immunity among specific under-served and under-immunized ethnic groups and age groups, in particular, Maori children, and young adults and adolescents.

5. The RVC notes New Zealand’s success in investigating the infection source of detected cases, and encourages continued commitment to conduct contact tracing.

6. The RVC encourages the development of innovative methods for reaching the high-risk group of international travellers, since infection of unvaccinated New Zealand residents travelling abroad is a potential route of MR importation.

Pacific island countries and areas

1. The RVC urges Vanuatu to introduce a second dose of MRCV into the routine schedule.

2. The RVC encourages Vanuatu, New Caledonia, Kiribati and Cook Islands to make rubella a notifiable disease.

3. The RVC requests the PICs to improve follow-up of recommendations from the SRVC and RVC.

4. The RVC encourages PICs that are not achieving 95% coverage with MRCV to continue to strive to improve routine immunization.

5. The RVC encourages PICs to improve efforts to fully investigate any AFR cases, and to conduct retrospective reviews to evaluate the sensitivity of surveillance systems to detect importations of measles or rubella, and requests this information to be included in the next report to the RVC.

6. The RVC encourages Vanuatu and Kiribati to consider conducting a supplemental immunization campaign with MRCV in 2019.

7. The RVC encourages PICs to work with WHO to develop strategies and mechanisms to conduct testing of arboviral-negative AFR cases for measles and rubella to enhance surveillance.
Papua New Guinea

1. The RVC urges Papua New Guinea to urgently plan and request support from funding partners for a national SIA with MRCV as soon as possible.
2. The RVC recommends that Papua New Guinea set a target date for rubella elimination, develop a national plan of action for MR elimination, and report this information in the next report to the RVC.
3. The RVC congratulates Papua New Guinea for reinvigorating the NVC, and the RVC endorses the NVC recommendations, including the request that the government release the results of the recent coverage survey to the NVC and share the final report of the National EPI review.
4. The RVC requests that Papua New Guinea include a summary of specific actions taken in response to the most recent RVC recommendations in the next report to the RVC.
5. The RVC encourages Papua New Guinea to leverage the successful Field Epidemiology Training Programme (FETP) to strengthen capacity for measles surveillance, case investigation and response.
6. The RVC recommends that Papua New Guinea select a subset of provinces to strengthen surveillance, to serve as sentinel surveillance sites as a step towards improved nationwide surveillance.
7. Given the vulnerability of the country to large-scale outbreaks, the RVC urges Papua New Guinea to develop MR outbreak preparedness and response plans, taking into consideration lessons learnt in past measles outbreaks and the current cVDPV outbreak.
8. The RVC encourages Papua New Guinea to seek information on VPD epidemiology from neighbouring countries to supplement surveillance information on domestic cases.

Philippines

1. The RVC expects the Philippines to identify the barriers for timely submission of the annual report and recommends working with WHO as needed to ensure future reports are timely.
2. The RVC recommends that the Philippines work at provincial and local levels to ensure that new birth cohorts receive the benefits of high MRCV coverage, and strengthen accountability of lower-level governments to achieve immunization targets.
3. The RVC urges the Philippines to work with WHO to plan and implement a quality SIA to fill immunity gaps that have accumulated due to very low immunization coverage among children born since January 2014.
4. The RVC encourages the Philippines to take proactive measures to improve demand and re-establish trust in public health immunization services.
5. The RVC recommends that the NVC directly engage with professional medical bodies to promote the safety and benefits of vaccinations.
6. The RVC recommends that the Philippines work to ensure availability of vaccine and strengthen forecasting and procurement processes to avoid stock-outs of vaccine.
7. The RVC urges the Philippines to exercise caution when deciding to introduce new vaccines that may negatively impact MRCV coverage.
8. The RVC encourages continued implementation of school-based exit checking, and urges development of strategies and programmes to opportunistically vaccinate young adults.
9. The RVC encourages the Philippines to develop, implement and evaluate well-functioning CRS surveillance.
10. The RVC urges the Philippines to use geographical epidemiological linkage for case confirmation to reduce unnecessary laboratory testing that does not inform public health action.

Republic of Korea

1. The RVC encourages the Republic of Korea to maintain high quality case investigation and source identification, noting that only one measles and one CRS genotype result were presented in the annual report.
2. The RVC recommends that countries that have achieved elimination continue to obtain genotype information from all cases of measles and rubella, even sporadic cases. The genotype information should be supplied to the WHO global sequence databases. Genotype information from imported cases contributes to efforts to monitor regional and global viral transmission patterns.

3. The RVC recommends that the Republic of Korea further work with private sector laboratories to improve submission of specimens for genotyping.

4. The RVC requests that the Republic of Korea report the number of MR tests conducted in private laboratories.

5. The RVC recommends that the Republic of Korea publish information on the success of their school-based vaccination check programme in a peer-reviewed journal.

6. In post-elimination countries, the RVC encourages classification as imported those cases in residents with any international travel history during the infectious period, without epidemiological or genotype evidence of an identified local source after thorough investigation.

7. The RVC requests that, while the standard MR discard rate remains below the target level, the Republic of Korea report supplemental information to describe the sensitivity and performance of MR surveillance.

Singapore

1. The RVC recommends that countries that have achieved elimination continue to obtain genotype information from all cases of measles and rubella, even sporadic cases. The genotype information should be supplied to the WHO global sequence databases. Genotype information from imported cases contributes to efforts to monitor regional and global viral transmission patterns.

2. In post-elimination countries, the RVC encourages classification as imported those cases in residents with any international travel history during the infectious period, without epidemiological or genotype evidence of an identified local source after thorough investigation.

3. The RVC recommends that Singapore publish the results of its detailed analysis of genotypic lineages to demonstrate elimination in the face of multiple importations.

4. The RVC requests that Singapore provide more detailed historical review of rubella and its epidemiological characteristics, in particular a description of past outbreaks.

5. The RVC requests that Singapore provide a detailed description of current preventive screening practices related to rubella and CRS.

6. The RVC recommends that Singapore further strengthen surveillance for AFR and consider strategies to fill the immunity gap among young adults to ensure sustainability of measles elimination.

Viet Nam

1. The RVC urges Viet Nam to implement all recommendations from the VPD surveillance review with a particular focus on the south of the country, including increased efforts to collect virological samples for genotyping.

2. The RVC encourages Viet Nam to particularly strengthen MR surveillance in primary care and adult-targeted settings.

3. The RVC urges attention to monitor and ensure full implementation and funding of MR activities by provincial governments.

4. The RVC encourages Viet Nam to develop a nationwide outbreak response plan, and to ensure that there is sufficient capacity to detect and respond to small outbreaks.

5. The RVC encourages Viet Nam to work with WHO to address the inconsistent sources of surveillance data, including identifying a unified denominator for coverage and surveillance.

6. The RVC encourages Viet Nam to collaborate with neighbouring countries, to develop and implement synchronized or coordinated surveillance and immunization activities.
Recommendations for all countries and areas

1. The RVC encourages all countries and areas, particularly in near-elimination or post-elimination phases, to aggressively investigate cases to identify contacts, determine the index cases, and obtain and report genotypic information.
2. The RVC discourages using negative PCR results as the sole basis to discard suspected MR cases if IgM is positive.
3. The RVC discourages including data from serological testing that is done as part of asymptomatic screening programmes as part of the numerator or denominator when calculating surveillance quality indicators such as discard rate.
4. The RVC requests countries and areas to present epidemiological analysis by genotypic lineage, including all cases of unknown source that have the same genotype or untyped genotype.
5. The RVC urges all countries and areas to make CRS a notifiable disease to supplement rubella surveillance and ensure appropriate infection control measures.

3.2.2 Recommendations for WHO

1. The RVC recommends that WHO facilitate regular meetings among Greater Mekong Subregion countries, including countries in the WHO South-East Asia Region, to develop and implement specific plans for coordinated activities or initiatives for synchronized MR elimination (e.g. cross-border notification of outbreaks, synchronized SIAs).
2. The RVC recommends that WHO publish a regional update on progress to achieving regional rubella elimination, including the status of legal frameworks in the region such as implementation of school checks, CRS as a notifiable disease.
3. The RVC encourages WHO to work with New Caledonia to support establishment of a subregional reference laboratory.
4. The RVC encourages WHO to support the establishment of mechanisms in the PICs for MR testing of samples that are negative for arboviruses, to improve surveillance sensitivity.
5. The RVC recommends that WHO work with the SRVC and RVC to define alternative guidance for smaller PICs for reporting relevant evidence for MR elimination.
6. The RVC recommends that WHO explore mechanisms to involve the Pacific Syndromic Surveillance System in improving surveillance for MR elimination, and improve the linkage between surveillance and response.
7. The RVC requests that WHO facilitate a national consultation to develop subnational plans for plans for improving MR immunity in the Philippines appropriate to the local situation and challenges.
8. The RVC requests WHO to specifically request the following information from countries and areas in their next annual progress report: (i) information about source of denominators, (ii) when those data were collected, (iii) possible sources of error, and (iv) any specifically excluded populations including undocumented or migrant populations.
9. The RVC recommends that WHO work directly with countries and areas to improve accuracy of denominators.
10. The RVC recommends that WHO work with Papua New Guinea and the Philippines to provide a six-month update to the RVC on the status of implementing this year’s recommendations.
11. The RVC requests WHO to provide clear instructions on how to report genotype information in the annual progress report from countries and areas.
12. The RVC requests WHO to create a dashboard to allow the RVC to monitor progress on implementation of recommendations by the Secretariat.
13. The RVC recommends that WHO explore how the Pan American Health Organization (PAHO) and the WHO South-East Asia Region deal with special circumstances of small island countries for verification of MR elimination, to help guide verification of MR elimination in the PICs.
ANNEXES

Annex 1. List of Regional Verification Commission members and Secretariat

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<td>23. Side Meeting with NVC Malaysia and Ministry of Health, Malaysia</td>
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