SIXTH ANNUAL MEETING OF THE REGIONAL VERIFICATION COMMISSION FOR MEASLES ELIMINATION IN THE WESTERN PACIFIC

12–15 September 2017
Beijing, China
Participants of the Sixth Annual Meeting of the Regional Verification Commission for Measles Elimination in the Western Pacific
12–15 September 2017
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MEETING REPORT

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NOTE

The views expressed in this report are those of the participants of the Sixth Annual Meeting of the Regional Verification Commission for Measles 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 Sixth Annual Meeting of the Regional Verification Commission for Measles Elimination in the Western Pacific in Beijing, China from 12 to 15 September 2017.
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Annex 1. List of participants

Annex 2. Meeting programme

Keywords:

Measles – prevention and control / Rubella – prevention and control / Vaccination / Diseases eradication
SUMMARY

The Sixth Annual Meeting of the Regional Verification Commission for Measles and Rubella Elimination in the Western Pacific was held in Beijing, China from 12 to 15 September 2017.

The objectives of the sixth annual meeting were:

1. to review the annual progress reports of the 16 national verification committees (NVCs) and the Subregional Verification Committee (SRVC) and make recommendations for the achievement of measles and/or rubella elimination; and

2. to verify the maintenance or achievement of measles and/or rubella elimination for countries and areas that have achieved these goals.

The Regional Verification Commission (RVC) members reviewed the annual progress reports submitted by the NVCs and the SRVC. In 2017, New Zealand was verified as having achieved measles elimination, and the Republic of Korea and New Zealand were verified as having achieved rubella elimination, for a period of at least 36 months since the time of the last known endemic case in the presence of high-quality surveillance and supportive genotype evidence. In addition, Australia, Brunei Darussalam, Cambodia, Hong Kong SAR (China), Japan, Macao SAR (China) and the Republic of Korea were confirmed to have sustained measles elimination after being verified in 2014 through 2016. RVC members made country- or area-specific recommendations to each of the NVCs and the SRVC, as well as to the WHO Regional Office for the Western Pacific.
1. INTRODUCTION

1.1 Meeting organization

The Sixth Annual Meeting of the Regional Verification Commission for Measles and Rubella Elimination in the Western Pacific was held in Beijing, China, from 12 to 15 September 2017. Participants included 11 members of the Regional Verification Commission (RVC), five staff members from the WHO Regional Office for the Western Pacific, two staff members from WHO headquarters, and one observer 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 the annual progress reports of the 16 national verification committees (NVCs) and the Subregional Verification Committee (SRVC) and make recommendations for the achievement of measles and/or rubella elimination; and

2) to verify the maintenance or achievement of measles and/or rubella elimination for countries and areas that have achieved these goals.

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 2016 of one more area in the Region as having achieved interruption of endemic measles virus transmission for a period of at least 36 months. 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 Rose Capeding.

2.2 Global update on measles and rubella elimination

Among the key highlights of this session were the updated 2016 figures for global measles-containing vaccine first dose (MCV1), second dose (MCV2) and rubella-containing vaccine (RCV) coverage (85%, 64% and 46%, 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. Developments in the South-East Asia Region of potential interest to countries in the Western Pacific Region were also discussed, including phased measles–rubella (MR) vaccine introduction in both India and Indonesia in 2017 and 2018, as well as a recent measles outbreak in Thailand. Other global developments discussed included recent MR investments by Gavi, the Vaccine Alliance, polio transition and its possible impact on MR elimination, the midterm review of the Measles & Rubella Initiative (M&RI) strategic plan 2012–2020, and an update on micropatch array vaccine delivery technology.

2.3 Verification commissions for measles and rubella elimination in other regions

Globally, all six WHO regions have measles elimination goals, and three regions have rubella elimination goals. To verify elimination, four of six regions have or have had regional verification commissions (RVCs) start verifying countries as having achieved measles elimination, with the Eastern Mediterranean Region and the African Region making plans to have functional committees by
the end of 2017. The European Region and the Region of the Americas have been verifying rubella elimination. To date, 75 Member States have eliminated measles and 68 Member States have eliminated rubella. RVCs in each of the regions have gained valuable experience in the practical implementation of the hypothetical 2013 framework. Exceptions exist in every region, and regions are handling these exceptions differently. In order to support the RVCs, a meeting was convened in June 2017 of RVC chairs and the measles rubella Strategic Advisory Group of Experts (SAGE) working group. The objectives of the meeting were to: 1) share lessons learnt between the RVC chairs; 2) standardize verification among the regions; 3) identify current gaps in guidance; 4) achieve consensus on the need for and potential terms of reference of a global coordinating commission to support RVCs; and 5) introduce country categorization. Regarding the latter objective, the measles rubella SAGE working group has proposed a new category in addition to the verified as eliminated, endemic and re-established categories. This new category is for NVCs/RVCs to classify countries as having been “eliminated/interrupted but not verified”, which is absence of transmission for at least 12 months but not verified.

The RVC chair meeting concluded that there has been good progress in the regions, many lessons learnt, but also growing pains. Next steps include updating the global surveillance standards whereby exceptions to current surveillance will be addressed, and updating the global framework where rubella-specific issues will be highlighted. As another point of follow-up, WHO headquarters will arrange a webinar on congenital rubella syndrome (CRS) surveillance and MR genotype. Discussion focused on the new proposed country category of “eliminated/interrupted but not verified”. Some RVC members felt like it would send the wrong message to countries and result in apathy about applying for verification, and that it would lessen the prestige of verifying elimination. There was concern that this was to improve the numbers but not really helping to achieve the objective of achieving elimination.

2.4 Measles and rubella elimination in the Western Pacific Region: overview, progress in 2016-2017 and issues to be addressed in 2018–2020

The WHO Regional Committee for the Western Pacific first endorsed measles elimination as a goal in 2003 and set a target year for elimination of 2012 in 2005. In 2014, the Regional Committee endorsed a regional framework for implementation of the Global Vaccine Action Plan, which includes goals for five of six WHO regions to achieve measles and rubella elimination by 2020. After experiencing a period of historically low measles incidence in the Region in 2012, coinciding with the target date for measles elimination, the Western Pacific Region experienced a resurgence of measles transmission in 2013-2016. This resurgence revealed new epidemiological challenges to measles elimination: first, the population immunity gap has shifted to adolescents and young adults who are not targeted by existing immunization strategies; and second, significant geographic diversity exists in the age distribution of susceptible individuals within countries with large populations. In addition, challenges related to programme capacity or preparedness have been revealed, including epidemiological surveillance, laboratory support, outbreak preparedness and response, and partnership and collaboration. Special challenges also arise from achieving measles and rubella eliminating amidst ongoing endemic transmission in the Region. In 2018–2020, Member States should develop or review their national strategies and plans of action for measles and rubella elimination: 1) to protect populations not ordinarily targeted during routine or supplemental immunization; 2) to strengthen hospital infection control policies and procedures; 3) to conduct programme review and risk assessment to understand areas or populations needing special attention or programmatic strengthening; 4) to improve planning for outbreak investigation and emergency response; and 5) to improve intersectoral and cross-border cooperation to support innovative and effective immunization policies.

2.5 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, 31 provincial laboratories, 331 prefecture laboratories. High proficiency in the laboratory network with its strong quality assurance provided laboratory confirmation and genotype evidence to support measles and rubella elimination and
verification in the Region. For the countries with verified measles elimination, genotype evidence supports the interruption of endemic measles virus transmission. For endemic countries and near-to-elimination countries, countries have genotype data providing a good baseline for the genetic information. Four predominant genotypes – H1, D8, B3 and D9 – were detected in the Region during 2016–2017.

2.6 Verification of rubella elimination: similarity to and difference from verification of measles elimination

For verification of rubella elimination, the NVC should submit a full and detailed progress report specific to rubella. The document is to include all the five lines of evidence, as with measles elimination: disease epidemiology, surveillance system characterization, demonstrations of population immunity, sustainability of the national immunization programme (NIP) and genotype evidence. As the consequences of rubella infection are greatest among pregnant women – and some countries have a history of protecting women against rubella through vaccination – it is critical that all relevant lines of evidence are presented by sex and age, and include adults. This is recommended for all countries. Surveillance for CRS demonstrates the consequences of rubella infection. Surveillance among infants is critical, since up to 50% of affected pregnancies may be missed due to subclinical rubella infection. CRS surveillance can be tailored according to health system capacity. It can be based on the identification of sentinel signs, or reports of suspected CRS by medical professionals. A retrospective review of clinical records is informative at any time, but particularly following a rubella outbreak or when applying for verification.

2.7 Country and area reports

2.7.1 Australia

Epidemiology of measles and rubella: In 2016, 99 measles cases were detected: 56% were either imported or import related, and 44% had an unknown source of infection. However, 26 of the unknown cases were linked to three outbreaks where the index cases’ source of infection could not be determined. Three cases were confirmed by epidemiological linkage. The major measles risk in Australia was identified as international travel by young adult who are not vaccinated, reintroducing the virus into the country.

In total, 17 rubella cases were identified in 2016, with 5 (29%) classified as imported. All rubella cases were over 15 years of age. The highest incidence reported was from New South Wales (NSW) at 1.15 per million population (9 cases).

No instances of congenital rubella were identified in 2016.

Quality of measles and rubella surveillance: There was a high proportion of unknown source cases in 2016 and 2017. However, 12 of 15 outbreaks did identify a clear importation history. The remaining indicators were met for measles, where needed using well described alternative data. Improvements are still needed in the proportion of the second administrative level reaching the target of ≥2 non-measles, non-rubella suspected cases per 100,000 population, and the percentage of specimens received at the laboratory in a timely manner. CRS is nationally notifiable, for both probable and confirmed cases.

Measles and rubella population immunity: Coverage of measles and rubella-containing vaccine (MRCV) 1 and 2 remains high, with small but observed improvement at the national level. The 2012 serosurvey showed measles immunity significantly below 90% among individuals now 15–24 years of age, and borderline immunity levels up to 39 years, as seen in the 2016 outbreak cases. However, the outbreaks were of limited size and generations. Additional supplementary immunization activities (SIAs) occurred in Western Australia, targeting indigenous Australian populations, as a result of a mumps outbreak.

Programme sustainability: In 2015, Australia updated its national guidelines governing the response to notifiable disease events. The National Immunisation Program is fully self-funded. The Government has continued support for the “No Jab, No Pay” programme for recipients of family assistance payments with expansion to include catch-up vaccinations for those up to 19 years old, and
among all refugees and humanitarian immigrants. The federal budget for 2017–2018 also includes funds for a three-year immunization awareness and promotion campaign. The measles comprehensive multi-year plan expired in 2016, and a new plan will be submitted with the 2017 report, along with one for rubella.

**Genotype evidence:** Measles outbreak genotypes B3 (1 outbreak, 2 cases), D4 (1 outbreak, 2 cases) and D8 (13 outbreaks, 62 cases) were detected. Seven of the outbreak strains had exact matches in the Measles Nucleotide Surveillance (MeaNS) database. The remaining, but one, D8 strains were classified as Victoria (2), Hulu Langat (1) and Osaka (3) named strains. This variety of measles strains gives evidence against ongoing transmission.

### 2.7.2 Brunei Darussalam

**Epidemiology of measles and rubella:** In 2016, there was one imported case of measles, in a 19-year-old university student, a permanent resident of Malaysia, with no history of measles vaccination, following contact with an infected sibling in Malaysia. No cases of rubella were identified in 2016.

**Quality of measles and rubella surveillance:** All the surveillance performance indicators met WHO’s targets. 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 cases. There was no description of CRS surveillance.

**Measles and rubella population immunity:** High national immunization coverage was maintained in 2016, with 98% for MCV1 and 97% for MCV2. None of the four administrative districts had coverage below 90%. Rubella population immunity was not described except to note that measles, mumps and rubella (MMR) vaccine was introduced in 2002.

**Programme sustainability:** The NVC did not meet annually. It met in December 2014 and in May 2017. It did not meet in 2016. Adequate budget is provided to ensure that there is sufficient supply of vaccines for routine vaccination and outbreak management.

**Genotype evidence:** The B3 genotype of the single imported measles case was identified by the Victorian Infectious Diseases Reference Laboratory.

### 2.7.3 Cambodia

**Epidemiology of measles and rubella:** In 2016, among 65 confirmed measles cases during an extended outbreak, 51% were <9 months of age, and 20% between 10& 23 months.

There have been decreasing rubella cases since 2014. 2 CRS cases were identified in 2014. In 2016, Cambodia established CRS sentinel site surveillance at Angkor Hospital for Children with the support from WHO.

**Quality of measles and rubella surveillance:** Surveillance identified a maximum of 10 chains of measles transmission, provided genotype analysis, and identified transmission at hospitals. Active case finding in the community was conducted during the MR SIA.

72% of 2nd administrative levels (target >80%) reported > 2/100,000 discarded measles cases . 88.3% of suspected cases had adequate investigation in 2016. 47% of specimens were received at laboratory within 5 days of collection.

All national laboratory indicators met the targets, with samples from 100% of outbreaks sent to the Regional Reference Laboratory (RRL) for virus detection and genotype

The 2016 and 2017 rubella cases were classified as endemic. No case was investigated after diagnosis and no genotype was performed.

The country is considering sending confirmed rubella specimens to the RRL.

**Measles and rubella population immunity:** MCV1 and MCV2 coverage estimates were reported as over 100% for both doses nationally in 2016. According to province, 13 provinces reported coverage
of over 100%, and another 10 provinces had coverage below 90%. Only two provinces had between 90% and 100% coverage. Four provinces had below 90% MCV coverage for both doses. Generally MCV2 coverage is low.

Despite repeated importations with secondary cases, transmission was interrupted, suggesting reasonably high population immunity, with the longest transmission chain five or eight months.

**Programme sustainability:** There is continued support by the Minister of Health, supporting NIP MR SIAs, catch-up immunizations and revision of the MR immunization schedule to close the immunity gap among children.

The Government has ordered an additional 425 000 doses of MR for the next two years using their own funds, to ensure the vaccine supply and for outbreak response.

Cambodia adopted the rubella elimination goal in December 2014 and is developing a rubella elimination plan.

**Genotype evidence:** Genotype information is available for 9 of 10 outbreaks, B3 and D8 were isolated. B3 accounted for 42 (65%) of the reported cases, D8 for 6 cases (9%) and the genotype of the other 17 cases (26%) were unknown due to various valid reasons. No rubella genotype was performed.

### 2.7.4 China

**Epidemiology of measles and rubella:** In 2016, incidence decreased to 18.1 per million population; measles deaths were down to 18 from 24 in 2013. All confirmed cases (n=23 960) were classified as having an endemic source of infection. An early but low seasonal peak occurred in March/April. Most cases occurred in Western provinces, and among children less than 5 years old (48%) and young adults aged 25–39 (26%). Epidemiology varied significantly by province, with some provinces experiencing the vast majority of cases in adults (e.g. Beijing) and others with most cases among children younger than 5 years. A total of 48% of cases involving cases of children less than 15 years old were not vaccinated. There were 230 outbreaks in 2016, down from 329 in 2015.

Rubella reached a historic low incidence in 2016 (3.3 per million population). All cases were categorized as endemic, and 1.5% were epidemiological linkages. Seasonal peaks in April/May are still evident. The geographic distribution and age distribution of rubella cases varies by province; however, the areas with highest rubella incidence do not correlate with the areas of highest measles incidence. There were 18 outbreaks in 2016, most often occurring in school settings.

**Quality of measles and rubella surveillance:** China achieved or surpassed the threshold for all indicators of quality for epidemiologic and laboratory combined MR surveillance. Rubella was integrated into measles case-based surveillance in 2014 and 84% of rubella cases were laboratory-confirmed. Combined MR surveillance met or surpassed quality indicators.

Sentinel CRS surveillance has been functioning as a pilot programme in two provinces since 2009 but is not nationwide. CRS case definition was recommended for integration with the existing nationwide birth defects surveillance system by an international consultation on MR elimination held in 2016.

**Measles and rubella population immunity:** Two-dose coverage of MCV was 99% in 2016 by administrative coverage, but 114% by estimated coverage using national birth cohort estimates. Modelling indicates substantial residual immunity among young adults.

The 2014 serosurvey indicates 96% measles seropositivity among 1–5-year-olds, 94% among 5–14-year-olds and 89% among 15–29-year-olds. SIAs were conducted in 21 provinces following measles risk assessments.

China has a high risk of health-care-associated transmission; only 43% of health-care workers had received at least one MCV dose in a health-care worker coverage survey.

The 2014 serosurvey indicates 93% rubella seropositivity among those 1–4-year-olds, 82% among 5-14-year-olds and 88% among 15–29-year-olds. An immunity gap exists among adolescents of varying magnitude by province due to MR introduction without a wide age-range catch-up campaign.
Modelling shows that the current immunity gap among high school students places China at risk of rubella outbreaks with CRS in the next 10–15 years.

**Programme sustainability:** China is fully committed to the elimination of measles and rubella, and convened a consultation in 2016 to plan its national strategy for measles and rubella elimination. A detailed programme risk assessment is ongoing to develop tailored subnational strategies.

Modelling demonstrated that the optimal strategy for closing the rubella immunity gap is to immunize children who do not have adequate documentation of MR vaccines.

**Genotype evidence:** H1 remains the principal circulating strain of measles except for three imported D8 and 10 VAC strains viruses isolated in 2016. A total of 30% of measles outbreaks in 2016 had genotype results, steadily increasing since 2014. No rubella genotype evidence was reported.

### 2.7.5 Hong Kong SAR (China)

**Epidemiology of measles and rubella:** In 2016, there were 193 suspected measles cases and 9 confirmed measles cases (1 imported, 8 unknown, both laboratory confirmed); 2 cases were unvaccinated and 5 cases occurred in those older than 30 years. From January to March 2017, there were seven suspected measles cases and two confirmed measles cases (1 imported, 1 unknown, both laboratory confirmed).

**Quality of measles and rubella surveillance:** All surveillance (epidemiological and laboratory) indicator targets for 2016 were met. There has been long-standing rubella surveillance and also CRS surveillance since 2008. The report suggests good data quality.

**Measles and rubella population immunity:** There are high vaccination coverage rates of over 95% for MMR vaccine among primary 1 and primary 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%. There is some variation in estimates due to the small sample size, and some possible bias towards more vaccinated individuals due to the sample selection process.

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. 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 or rubella outbreaks were reported, and there is no evidence of endemic measles virus transmission. 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:** There were 159 confirmed measles cases in 2016 (and 8 more clinically compatible cases) and 144 confirmed cases to date in 2017; 89% were imported or import-
related in 2016. Measles cases occurred mostly in the Kanto (36%) and Kansai (53%) regions. More than 70% of cases were over 15 years of age.

There were 101 confirmed rubella cases and 26 clinically compatible cases in 2016; in 2017 to date, there have been 30 confirmed cases and 5 clinically compatible cases. Of these, 11% are documented as importations and 64% of rubella cases were older than 30 years. Rubella cases were distributed across the regions with the highest incidence detected in Aichi at 2.4 cases per million.

No CRS cases were reported.

**Quality of measles and rubella surveillance:** All surveillance indicators were met. The sensitivity of the system is high with a measles discard rate at 23 per 100 000. Uniformity of the sensitivity was not determined.

The report identified importations as inevitable, but stated that delayed diagnosis was a concern resulting in large outbreaks in 2016.

All rubella surveillance indicators were met, and the sensitivity of the system is high with a rubella discard rate at 54 per 100 000 at the national level.

CRS is a notifiable disease with both clinical and laboratory criteria. In previous years, there have been detected cases, but no cases were identified in 2015 and 2016.

**Measles and rubella population immunity:** MCV1 coverage was 96% and MCV2 coverage was about 93% in 2014 and 2015. The 2016 serosurvey in 23 prefectures showed more than 95% immunity in all those aged at least 2 years.

**Programme sustainability:** The National Committee for Promoting Measles & Rubella Control continues to ensure that MR vaccination in every prefecture exceeds 95%; if MCV2 coverage fails to reach 90%, actions are undertaken including vaccination reminders, alerts to the child vaccination programme and sharing of coverage data with municipalities to increase uptake.

In 2016, Japan updated its outbreak and preparedness response plan, and conducted a risk assessment as well as vaccination awareness and promotional activities.

**Genotype evidence:** In 2016, Japan detected four separate strains of H1, one of which resulted in a single large outbreak.

In 2016 and early 2017, 10 distinct strains of D8 were identified; 7 were associated with 14 outbreaks. 1 strain in particular was associated with 7 outbreaks, late in 2016 and early 2017. In 2017, there was one B3 outbreak.

One rubella outbreak was genotype 2B, which matched a strain identified in the Region in 2015.

### 2.7.7 Lao People's Democratic Republic

**Epidemiology of measles and rubella:** A measles and circulating vaccine-derived poliovirus type 1 (cVDPV1) outbreak in 2015/16 occurred in the Hmong community (geo-topographical location) and other ethnic groups, associated with vaccine hesitancy and an inadequate health-care system.

The most recent measles outbreak in 2016 was in Phongsaly province, where routine immunization coverage is low. There were eight confirmed cases and six confirmed by epidemiological linkage; two were laboratory confirmed but did not show clinical manifestations. The outbreak affected unvaccinated children younger than 5 years old, especially among the Hmong minority ethnic group.

There were no import-related measles cases in 2016, compared to 2014 (four cases) and 2015 (six cases). In 2015, there were 56 measles cases confirmed by laboratory and epidemiological linkages, 91% from one province.

The NIP and WHO prepared the Measles Risk Assessment for 2016, using four criteria: population immunity, surveillance quality, programme delivery performance, and threat/probability assessment/population vulnerability.
Rubella cases continued to decline in 2016, with 40 cases total (33 EPI linked, 7 laboratory confirmed).

Quality of measles and rubella surveillance: A passive disease surveillance system for reporting of fever and rash – Lao Early Warning Alert and Response (EWAR) Surveillance System – is in place at health centres at the district, provincial and national levels. Fever and rash cases can be reported from anyone, anywhere.

Surveillance met the reporting rate indicator; however, the case investigation and specimen collection indicators were not met and showed no improvement from the previous year. A declining trend in surveillance indicators was also observed at the subnational level. The low incidence of measles appears to be confounded by the low proportion of suspected cases with adequate specimen collection.

There is no functional CRS surveillance system, but there is a plan to establish a system to identify CRS cases through review of rubella in pregnancy registries or retrospective medical records or sentinel surveillance.

Measles and rubella population immunity: MR vaccine was introduced in 2011. Coverage has been below 90% for the last three years. Lower MCV coverage in 2016 (76% by WHO/UNICEF report) or (65% by National Institute of Public Health reporting) could be due to several rounds of polio SIAs resulting in less attention for routine immunization under the Expanded Programme on Immunization (EPI). One province has over 90% MV coverage; six provinces have 80–90% coverage; and another six provinces have below 70% coverage.

Periodic SIAs are performed: the last activity occurred in January 2017, during a bivalent oral polio vaccine (bOPV) SIA targeting those aged 9 months to less than 5 years.

Support from Gavi, the Vaccine Alliance, for MCV2 introduction beyond 1 year of age is planned in the third or fourth quarter of 2017.

A survey of the vaccination history of 512 children with fever and rash revealed that 55% had no history or unknown history, and 45% had received at least one dose of MR vaccine.

Programme sustainability: The immunization programme is a top priority of the Government, which is significantly increasing financial support. The Government supports regular outreach services at least four times a year in ethnic minority communities and other high-risk areas. Additionally, there is technical and financial support from several international agencies and donor partners. There is no specific national measles outbreak response plan yet.

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 RRL 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: No measles cases were identified in 2016, among 12 suspected cases. One confirmed rubella case was detected in 2016 in a patient over 30 years of age with an unknown source of infection. No CRS cases were identified in 2016.

Quality of measles and rubella surveillance: The non-measles, non-rubella discard rate was 1.70 per 100 000. All other indicators were met. CRS has been notifiable since 1999 at the two obstetrics and gynaecology hospital departments in the country (one public and one private). Case definitions were provided.

Measles and rubella population immunity: MCV1 and MCV2 coverage was reported above 97%, as was seen in 2014 and 2015.

The annual serosurvey of a random convenience sample for 2016 showed less than 5% seronegativity in those over 2 years of age. The annual serosurvey will include rubella testing beginning in 2017.
Programme sustainability: The NVC believes that high vaccine immunization and reliable surveillance are sustainable until global verification of measles elimination. The last risk assessment was conducted in 2016. The immunization programme is self-funded.

Genotype evidence: No measles cases were detected this year. The rubella sample did not provide a genotype result.

2.7.9 Malaysia

Epidemiology of measles and rubella: A total of 1587 measles cases were reported in 2016, and the most affected age group was those less than 7 years of age; 90% of cases of 8 months–15 years old were unvaccinated, and 9.5% had only one dose. Most outbreaks occurred within a household.

Since 2010, the inter-epidemic cycle has shortened to a three-year cycle, though the number of cases has reduced significantly. This suggests unequal vaccination coverage, and that some areas still have significant measles susceptibility.

High-risk groups mentioned include the mobile international population that do not visit clinics, populations with geographic accessibility challenges, adolescents and adults (since 2015), and a group highly resistant to vaccination, which, while small, is influential with media support.

Rubella cases were mostly male. The last rubella outbreak occurred in 2012/13. In 2016, there were approximately equal cases between males and females.

Quality of measles and rubella surveillance: Nine importations were detected, but no cases were linked to these importations. No cases since 2009 were ever linked to importations.

There were 53 outbreaks of between 6 and 10 cases.

The national laboratory is WHO accredited, but the subnational lab is accredited for serology only.

A total of 35% more samples were tested in 2016, with 204 genotype results.

Rubella data have been presented since 2007. Rubella is nationally notifiable since 2010; CRS is not notifiable, but Health Management Information System data report CRS admission rates.

Measles and rubella population immunity: Targeted SIAs were conducted in high-risk areas in 2016. SIA was successful in Kuala Lumpur but not very successful in Sabah and Selangor due to various factors.

The 2016 coverage survey showed 86% of children 12–23 months were fully vaccinated. The schedule changed in 2016, and it is unclear from the report whether fully vaccinated means one or two doses of the measles vaccine.

School-entry checks became compulsory following a diphtheria outbreak in 2016; children needing vaccination are referred to nearby public clinics and private health facilities.

There was a sex disparity of cases before 2016, suggesting high rubella immunity among women.

Programme sustainability: The measles elimination programme has strong commitment from health staff and leadership, including the availability of adequate resources. Of concern is measles case management and maintaining immunity.

Risk assessments for measles are conducted by all states at least every 2 years, to assess the risk of outbreaks.

Genotype evidence: D8 (n=62) and D9 (n=82) are endemic strains. B3 (n=60) was introduced in 2015, causing outbreaks also in 2016. D9 was not detected in Eastern Malaysia.

2.7.10 Mongolia

Epidemiology of measles and rubella: The 2015 measles outbreak continued into 2016; 2811 confirmed cases out of 27 332 suspected cases had been confirmed by laboratory testing in 2016. There were also 132 deaths in total.
The age distribution of measles was bimodal with a small peak in the age group less than 4 years and a large peak ranging from 10–14 years to over 30 years (peak in 20–29 years age group).

A significant decline in cases was observed beginning in August 2016, though sporadic cases continued through the end of the year. The outbreak identified new risk groups born between 1986 and 1998, and also individuals born in the provinces, suggesting the resurgence occurred mainly in the population born before the start of the present measles elimination programme who were not exposed to the measles epidemics, and those not yet of vaccination-eligible age (less than 1 year). The accumulation of measles-unexposed population can be attributed to sparsely distributed population except in Ulaanbaatar.

A total of 27 rubella cases were detected by parallel testing of acute fever and rash cases. Identified cases were primarily those younger than 1 year and 20–29 years of age. The older cases were less likely to know vaccination status, and most of the cases without any doses were less than 1 year of age. Rubella detection peaked in April and May 2016.

**Quality of measles and rubella surveillance:** The measles outbreak resulted in decreased ability to investigate (8%), sample (14.4%) and testing of cases. The performance indicator percentage of second-level administrative units reporting more than 2 per 100 000 discarded measles cases improved and reached the WHO target due to enhanced surveillance in response to the outbreak. The laboratory indicators were met, suggesting the testing process was timely, once samples were collected.

CRS sentinel surveillance is planned to be reinvigorated.

**Measles and rubella population immunity:** The addition of a zero dose of measles vaccine at 6 months of age was implemented in October 2016 in response to the outbreak, with 98% coverage over four months in Ulaanbaatar and five provinces.

MR vaccine coverage from 2016 was reported as 98.5% for both doses, consistent with recent years.

A nationwide MR SIA for young adults aged 18–30 years was conducted with vaccination coverage of 88.1%; which addressed an outbreak-identified immunity gap.

A nationwide measles and rubella serosurvey was done in the fourth quarter of 2016, with WHO headquarters support, covering nearly 4000 individuals aged 6 months to 35 years in all 21 provinces and the capital city by collaboration between the National Statistical Office and Ministry of Health, Mongolia. Data analysis is now ongoing.

**Programme sustainability:** Currently Mongolia is undergoing revision of vaccine-preventable disease (VPD) surveillance, diagnosis and treatment standards, and is current developing SOPs for measles outbreak response, which shows commitment to measles elimination. Additionally, the newly identified age-immunity gap was addressed through an effective SIA.

**Genotype evidence:** Genotype testing was done on a monthly basis and/or for cases reported from new places. The isolates of virus identified in Mongolia (H1) were similar to the isolates identified in China.

### 2.7.11 New Zealand

**Epidemiology of measles and rubella:** The last documented period of transmission longer than 12 months had the final case on 13 June 2012. Since then there were B3 outbreaks in 2014 (280 cases) and D8 in 2016 (103 cases). In 2016, cases (6 importations) were predominantly from two district health boards (DHBs) on the North Island, like the 2013/14 outbreak. These two DHBs are characterized by a higher average population density, larger proportion of Maori, and 10% excess low socioeconomic status when compared to the rest of the country.

Of all historical cases, 15% were below the age of vaccination (15 months). Of the remaining cases eligible for vaccination, 76% were not vaccinated.
A total of 68% of all cases were those eligible for the two-dose MMR vaccination schedule (5–29 years old). There was a noted significant reduction in cases and incidence among those 5–9 years of age, those included in the national immunization register (NIR) (born 2006 and after).

A total of 5% of all cases occurred in those born under a one-dose measles vaccination schedule (30–49 years old). Only 1% of cases occurred in pre-vaccine birth cohorts.

In 2016, there were three rubella cases. The last identified CRS case was in 1998.

**Quality of measles and rubella surveillance:** In 2016, six measles importations were identified, with only two unlinked D8 cases after investigation and 74% were lab confirmed. There is a variety of reporting sources. Median reporting delay for measles is four days. At the national level, New Zealand exceeds all epidemiologic surveillance indicators. One DHB failed the non-MR discard rate. The Western Pacific Region Measles Bulletin on 20 July 2017 gives the MR discard rate for 2016 as 1.1 per 100 000, with insufficient data for the remaining three variables.

One of five laboratories are WHO accredited, all accredited through International Accreditation New Zealand, which is a full signatory member of International Laboratory Accreditation Cooperation (ILAC) and Asia Pacific Laboratory Accreditation Cooperation (APLAC), complying with ISO/IEC 17011 Conformity Assessment.

The median reporting delay for rubella is eight days. Genotype capacity exists at the National Measles and Rubella Laboratory, which is WHO accredited.

CRS surveillance has been conducted through the New Zealand Paediatric Surveillance Unit, since January 1998, using the surveillance methodology of the British Paediatric Surveillance Unit, used for monitoring of rare conditions. Paediatricians are invited annually to participate (98% acceptance in 2012) and provide monthly solicited case reporting, with 90% monthly response rate in 2016. Case responses are cross-checked with other health data sources.

**Measles and rubella population immunity:** The 2016 cases suggest immunity gaps in affected areas, notably in those younger than 10 years of age. Those 10–19 years of age (born 1997–2006) are of an age to have been part of the routine immunization vaccination history, though not documented in the NIR.

Preliminary results from the 2014–2015 serosurvey suggest measles immunity of 73% in 15–34-year-olds, and 86% in 35–44-year-olds, both well below the measles herd immunity threshold. This is consistent with the 2005–2007 serosurvey and the outbreak data in Auckland for 2013–2014.

MCV1 coverage has shown moderate improvements since 2006 and is near 94%, across ethnicity and socioeconomic status. MCV2 coverage has held near 90% for those born since 2006. MCV2 continues to be just under 90% among the Maori and other ethnicities. Moderate improvements have been observed within deprivation quintiles. The new Ministry of Health DHB accountability framework includes a four-year milestone marker for improving coverage; some improvement was seen in 2016 for MCV2.

Rubella vaccination began in 1970 with low success, but high success was seen for a school programme targeting 5–9-year-olds. The policy was changed in 1979, to girls 11 years old, which remained until 1990 when MMR was introduced at 15 months, and the second dose was added in 1992 for all children at 10 years. Age of the second dose was reduced in 2001 to 4 years, with a catch-up programme for those 4–10 years of age.

Persons born since 1990 should have rubella immunity comparable to or higher than measles. There is a concern of low immunity among those between 15 and 26 years of age based on previous measles immunity assessment results (2005/07 serosurvey and 2014/15 provisional measles results), combined with the age distribution of unvaccinated measles cases.

The serosurvey in 2014/15 included rubella; provisional results showed low population immunity among 15–24-year-olds, and 85–87% immunity in those over 24 years, when rubella and measles were separate vaccines, with different vaccination schedules.
Programme sustainability: MMR vaccine is free to all eligible for New Zealand health services (born after 1969, without documented two MMR doses). The NIR is populated with birth records since 2006; since 2014 including some adult vaccination records. The NIR links with some patient management systems to improve vaccination follow-up. New Zealand has a programme to check vaccination status during school enrolment.

Genotype evidence: All typed measles cases were D8 genotype, with importation from India and Indonesia. Two unlinked cases had no travel history and no identified link, with more than 2 basis points difference from other 2016 strains in country (there was a 28-day gap between outbreak 1 and 2 of an unknown source).

No rubella genotypes were reported.

2.7.12 Pacific island countries and areas

Epidemiology of measles and rubella: In 2016, there were 278 suspected measles cases and 6 were confirmed. All measles cases in Pacific island countries and areas (PICs) since 2012 have been considered imported or import-related.

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. Performing indicators are improving over time in the subregion as a whole, though performance varies by country. The proportion of second-level administrative levels meeting the non-measles discard rate has decreased in 2016 compared to 2015. The proportion of suspected cases with adequate blood specimens has improved (now 74%).

Measles and rubella population immunity: All countries include a second dose of MCV in the routine programme, except for Solomon Islands and Vanuatu. The RCV has been introduced into 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: Solomon Islands are conducting an effective vaccine management (EVM) assessment in 2017. Nine PICs have school immunization laws requiring MCV prior to school entry. Generally there is strong governmental commitment to NIPs in the PICs. Most countries have not completed risk assessments or outbreak preparedness and response plans.

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: Measles outbreaks expanded from the North-Western provinces (September 2013), becoming nationwide by August 2014. A total of 49 acute fever and rash specimens were tested in 2016, and one rubella case was identified.

Quality of measles and rubella surveillance: Only 1.4% of suspected cases had lab testing in 2015. Few, if any, laboratory services for measles diagnosis exist in rural districts. The general reporting and testing of suspected cases appear sporadic, and the quality indicators are not easily interpreted at this time.

Measles and rubella population immunity: MCV1 coverage in 2016 was officially 51% and has ranged from 47% to 65% since 2006. SIAs also have a history of low coverage, most recently 67% in 2015, though several provinces had 0% coverage. With 50% of the annual birth cohort remaining susceptible to measles, the epidemiologic threshold for outbreaks is exceeded every second year.

Programme sustainability: The report states that 81% of routine immunization vaccines are self-funded. The NVC is not currently active.

Genotype evidence: There were no positive lab samples among the 1.4% of cases tested.
2.7.14 Philippines

**Epidemiology of measles and rubella:** There were 76 confirmed measles cases; 66% were younger than 5 years of age. Incidence of measles was 0.73 per million population. Incidence exceeded one case per million population in five regions.

There were 178 confirmed rubella cases; Incidence is 1.72 per million population. In 2016, 45% of cases were between 15 and 24 years old, driven by 26 cases in a high-school-based outbreak, and 81% of rubella cases among 15–19-year-olds were unvaccinated.

**Quality of measles and rubella surveillance:** Improvement is needed for surveillance indicators, especially at the subnational level, where three regions met the non-MR discard rate but 11 regions did not report enough suspect cases to exceed the discard rate. Investigation and sampling rates are near 65% nationally, with subnational range from 21% to 96%. Lab specimen tracking and timeliness is not consistent. The national measles laboratory has been WHO accredited since 2008, but request subnational labs to help with load and timeliness.

Parallel immunoglobulin M (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.

**Measles and rubella population immunity:** In 2016 there was a decline in MV and MMR coverage compared to 2015. The Reaching Every Purok (district) strategy may increase coverage up to 11% among 12–23-month-olds with missed vaccines. The school-based immunization programme conducted in 2015 and 2016 estimated 70% coverage of the grade 1 selective and grade 7 non-selective catch-up immunization programme (about 74% of birth cohort registered). The 2016 cases show low numbers of cases over 5 years, 50% with a history of vaccination.

The age distribution of rubella cases shows higher immunity among children younger than 14 years, but clear susceptibility in those aged 15–24 years.

**Programme sustainability:** Regional VPD surveillance officers had continued funding in 2016; however, it is annually renewed, which results in staff turnover at all levels. Surveillance is grossly underfunded, and the government officials rarely recognize its value. The data management system is still under development. Data analysis, feedback and other surveillance activities are often not active. Reporting of suspected cases from outpatient departments, emergency rooms and the private sector is rare. The Philippines’ comprehensive multi-year plan update was updated for 2016–2022 and now addresses vaccine needs beyond children and pregnant women, including adolescents and older people.

**Genotype evidence:** Genotype is an ongoing challenge, and only a few regions submit samples. There were 62 referrals for virus isolation. In 2016, two regions had five positive B3 samples; these regions are adjacent and are not representative of the country as a whole. In 2016, five regions had eight positive rubella 2B samples.

2.7.15 Republic of Korea

**Epidemiology of measles and rubella:** There were 18 imported and import-related measles cases. Ten of these cases occurred in five outbreaks.

In 2016, there were four confirmed rubella cases and seven clinically compatible cases. Cases are sporadic around the country and no longer have seasonality. Since 2011, there have been 73 confirmed cases and additional 56 clinical cases; only 14% of confirmed cases were not vaccinated, 38% of cases had one or more doses of rubella vaccination, and the remaining 48% were of unknown status. The clinical cases were more common than confirmed cases among those aged 5–9 years and with the two-dose vaccination. The last instances of local transmission were from an imported case in 2011; 89% of rubella cases have an unknown source of infection. The last CRS case occurred in 2012, born to a woman with a history of rubella during pregnancy.
Quality of measles and rubella surveillance: The surveillance indicators where data are available are high and generally exceed the WHO targets. The major exception is the reporting rate of discarded cases (0.6 per 100 000), which is a result of an alternative diagnostic and reporting paradigm.

The rubella surveillance indicators have shown improvement since 2013, where data are available, and exceed the WHO objective. The exception is the reporting rate of discarded cases (0.4 per 100 000), which is a result of an alternative diagnostic and reporting paradigm.

A Korean rubella and CRS surveillance system began in 2000 as a mandatory reporting system, with sentinel site surveillance in July 2015. Three suspected CRS cases were identified and all tested negative.

Measles and rubella population immunity: High coverage of both MRCV1 and MRCV2 doses continued in 2016. There has been programmatic use of RCV since 1983, with a second dose added in 1997. There is high two-dose coverage for those up to at least 35 years old. Coverage surveys documented two-dose coverage above 97% since 2011. A 2013 serosurvey documented 92.5% seropositivity in general, with slightly less immunity in women 30–40 years of age. The next serosurvey is planned in 2018.

Programme sustainability: The Republic of Korea fully funds the immunization programme and has previously achieved measles elimination. There is strong political support for immunization and maintaining measles elimination. Vaccination with MMR is provided for free for every child 0–12 years old living in the country, in both public and many private medical institutions. The sustainability of the rubella elimination programme is conjoint with measles, given the combined vaccine and concurrent diagnostic testing.

Genotype evidence: Among the outbreak cases, genotype identified H1, and two independent lineages of D8. One outbreak did not have an identified genotype and one rubella genotype was identified as 2B, in 2015.

2.7.16 Singapore
Epidemiology of measles and rubella: There were 126 measles cases, 68% below 10 years and 29% in those aged 25–44 years. The highest incidence occurred in those below the age of the first MRCV dose, and the second highest incidence among 1–4-year-olds (there has been high incidence in this group since 2010).

In 2016, incidence was 22 per million due to unvaccinated cases in family clusters; 75% of cases were associated with importation events, although 121 cases were locally acquired. There were 15 small outbreaks, with a maximum of six cases in one family (5 cases=1, 3 cases=2), 28% of all cases were part of a cluster.

Rubella incidence was two per million in 2016. Detected CRS cases have been below two per year since 1994 and five of the last seven congenital rubella cases were in foreigners who travelled to Singapore for treatment. There were 10 lab-confirmed rubella cases in 2016. Rubella incidence was greatest among children below 5 years old, and 30% of cases occurred among 25–34-year-olds. The highest incidence occurred among foreigners. There were four identified importations of five confirmed cases in 2016.

Quality of measles and rubella surveillance: A total of 18 measles importations were detected. Only one cluster did not have a genotype. All suspect cases were followed up and tested for both measles and rubella disease. The 2016 performance indicators were not met for the discarded non-MR rate, or percentage of suspected cases with adequate blood specimens. Most cases were confirmed by polymerase chain reaction (PCR), not blood specimen.

The Singapore General Hospital virology lab is the National Measles Laboratory and was WHO accredited in 2001. In January 2017, the National Measles Laboratory designation was assigned to the National Public Health Laboratory, which is not yet WHO accredited.
Rubella is notifiable since 1990. Four importations were detected. All suspect cases are followed up and tested for both measles and rubella disease.

Singapore uses a pregnancy registry to follow pregnant women with rubella infection, including testing of the infant for rubella infection and CRS.

**Measles and rubella population immunity:** Coverage has been over 95% for MMR1 since 2004. MMR2 coverage is over 90% (1998–2012); since changing the MCV2 age to 15–18 months in 2012, MMR2 coverage has been 86.2–89.5%. A seroprevalence study in 2010 highlighted a continuing immunity gap among residents born in 1991–1995.

**Programme sustainability:** The NVC provided the Ministry of Health with some key strategies to improve surveillance of measles cases.

**Genotype evidence:** Genotype detected B3 (3 importations, 37 cases), D8 (6 importations, 57 cases), D9 (no identified importations, 8 cases) and H1 (1 importation case).

A total of 18 rubella samples were submitted for genotype, and no viral isolates were obtained.

### Viet Nam

**Epidemiology of measles and rubella:** In 2016, Viet Nam reported the lowest number of confirmed cases (n=46) in the last decade, mostly from the southern region. Incidence was highest among children younger than 5 years, as in most years since 2010. A total of 25% of provinces reported measles cases in 2016. Seasonality peaks in February–April each year.

No measles outbreaks were documented.

Since the national MR campaign in 2014 targeting children 1–14 years old, case counts have been significantly reduced, though small-scale rubella outbreaks continue. The last rubella outbreak in 2015–2016 was primarily in industrial zones with about 800 suspected cases. Incidence was highest among adults 20–29 years, and mostly among women.

Rubella seasonality since 2012 has peaked early in the year, in March/April. Many CRS cases were reported from national hospitals in 2011 following a large outbreak.

**Quality of measles and rubella surveillance:** A surveillance system has been in place for measles since 2002, but still has recognized room for improvement. The target MR discard rate was met nationally and in 50% of provinces. Surveillance indicators are slightly improved from 2015: now 74% of suspected cases are investigated, and 51% of the suspected cases had specimens collected for laboratory testing. Laboratory result timeliness was high.

There are four measles laboratories, and two are WHO certified as national reference laboratories.

Rubella surveillance has been integrated with measles since 2006. CRS surveillance is established in three national hospitals; 18 CRS cases were confirmed in 2016, while only 4 CRS cases were identified in 2015.

**Measles and rubella population immunity:** Viet Nam reported improvement of MCV1 coverage nationally. However, 40% of provinces did not achieve 95% coverage of MCV2 (four provinces with less than 90% coverage). Disparities in MCV coverage were identified in both rural and mountainous areas. Case data confirm an ongoing immunity gap among preschool children less than 4 years of age. There has been lower MCV2 coverage since the age at immunization was reduced in 2011 from school-entry (6 years old) to 18 months.

Since 2015, MRCV is used for both MCV1 and MCV2. The programme conducted an introductory catch-up campaign in 2015 and 2016, which reached over 94.9% coverage in all children born since 1999.
Programme sustainability: All children aged 9 months and 18 months are eligible to receive two free vaccinations with MRCV. Government expenditure on EPI has gradually increased over the years, about 10% each year. Viet Nam has committed to the elimination goals of the M&RI. The NVC is well functioning, providing support to the Ministry of Health and EPI.

Genotype evidence: A total of 25 samples were submitted for measles genotype, but no viral genotypes could be isolated. The assumption is that H1 and D8 are endemic, and B3 was last reported in 2014. However, there was one documented exportation of B3 from Viet Nam to Singapore, and in Cambodia, bordering southern Viet Nam, in 2016 most cases (n=42) were apparent imports of B3.

3. CONCLUSIONS AND RECOMMENDATIONS

3.1 Conclusions

3.1.1 General conclusions

• The RVC emphasizes that the verification of the interruption of endemic measles and rubella virus transmission primarily assesses disease epidemiology and the implementation of surveillance and immunization programmes during the preceding 36 months. Subsequent measles or rubella virus importation may identify unknown susceptible individuals or subpopulations. Thus there is a need for ongoing annual evaluations by the programmes/NVCs and submission of annual reports to the RVC, providing the opportunity for corrective actions to close immunity and surveillance gaps.

• The RVC notes that well-conducted serosurveys, where feasible, are a complementary mechanism to identify population immunity gaps for corrective action.

• The RVC notes that every outbreak of measles, and patterns of measles outbreaks, present an important opportunity to identify and close programmatic and immunity gaps.

3.1.2 Conclusions for Australia

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

• The RVC notes the excellent description of detected imported cases, high performance of surveillance indicators and effort to confirm case status by supplementing serological confirmation with PCR testing.

• The RVC congratulates Australia for its strong political and social commitment to achieving high immunization coverage.

• The RVC notes the discordance between the relatively lower levels of antibody seroprevalence described by the recent serological survey, and the population immunity that can be inferred from recent measles epidemiology and coverage recorded in the NIR.

• The RVC notes that Australia 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.

3.1.3 Conclusions for Brunei Darussalam

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

• The RVC congratulates Brunei Darussalam on the detailed description of a high-quality case investigation in the measles and rubella progress report, and on having sufficient population immunity and robust case investigation and outbreak response capacity to prevent secondary measles cases.
• The RVC notes that Brunei Darussalam 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.

3.1.4 Conclusions for Cambodia
• The RVC assessment was that despite an extended period of measles transmission in Cambodia, endemic transmission has not been re-established.
• The RVC acknowledges the aggressive investigation and immunization activities conducted by Cambodia in response to measles cases and outbreaks in 2016–2017, which contributed to preventing re-establishment of endemic measles virus transmission.
• The RVC notes the large number and wide geographic distribution of discarded measles cases identified in 2016–2017, which provides additional reassurance that large-scale ongoing transmission was not missed by the surveillance system.
• The RVC acknowledges the ongoing threat of continuous importation of measles virus from neighbouring endemic countries.
• The RVC notes with concern that nosocomial transmission appears to have played an important role in the initiation and propagation of measles outbreaks in Cambodia.
• The RVC notes that reported vaccination coverage may not accurately reflect population immunity against measles and rubella in Cambodia due to a lack of reliable numerators and denominators used for calculating reported coverage.

3.1.5 Conclusions for China
• The RVC appreciates the steady improvement in surveillance quality at national and subnational levels, and notes that all surveillance indicators met the global standard in 2016.
• The RVC notes the very high administrative and estimated coverage of MCV1 and MCV2, and that very few counties in China have MCV coverage below 90%.
• The RVC notes the China NVC’s assessment that immunity gaps for measles and rubella exist among adolescents and young adults, which presents a particular risk for measles and rubella outbreaks in high-exposure and high-density settings where young people congregate, as well as a high cost and social burden due to the likely increase in cases of CRS, should the rubella immunity gap among adolescents and young adults not be effectively addressed.
• The RVC notes the commendable level of technical and political support for measles and rubella elimination efforts in China, including the high technical quality of the progress report, valuable national measles and rubella serosurvey, and use of modelling studies to identify strategies to close immunity gaps.
• The RVC notes that the regional proportion of imported measles cases with H1 genotype have dramatically decreased, in large part due to the great progress in reducing measles incidence in China.
• The RVC notes that there is a concentration of MR-susceptible young adults, with particular risk.
• The RVC notes that China is very near to achieving interruption of endemic rubella transmission, especially if immunity gaps among adolescents and young adults are urgently filled.
• The RVC notes that efforts to improve measles and rubella immunity in adolescents and young adults will help protect young children and infants too young to vaccinate.
• The RVC notes with approval China’s study to evaluate immunization among health-care workers, and shares the NVC’s concern for the risk of health-care-associated amplification of measles and rubella outbreaks if health-care worker immunity is not improved.
3.1.6 Conclusions for Hong Kong SAR (China)

- The RVC verifies that Hong Kong SAR (China) has sustained interruption of endemic measles virus transmission, despite frequent measles virus importations due to the high volume of population movements to Hong Kong SAR (China) from measles-endemic countries. This achievement demonstrates the high performance of both immunization coverage and surveillance.

- The RVC notes 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.

3.1.7 Conclusions for Japan

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

- The RVC congratulates Japan on the proactive and appropriate use of International Health Regulations (IHR) mechanisms to report the Kansai Airport measles outbreak.

- The RVC congratulates Japan on the high-quality epidemiological investigation and description of identified cases, as well as detailed analysis and presentation of genotype data. This presentation of genotype data represents “best practice” examples for other countries in the Region.

- The RVC appreciates the inclusion of the peer-reviewed manuscript describing the Kansai Airport outbreak investigation as supporting data in the annual progress report.

- The RVC notes that Japan 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.

3.1.8 Conclusions for the Lao People’s Democratic Republic

- The RVC notes with concern that immunization coverage is very low in many provinces of the Lao People’s Democratic Republic.

- The RVC recognizes the large programmatic effort directed towards the cVDPV outbreak response in 2016 and 2017 that may have negatively impacted routine immunization coverage and surveillance performance but congratulates the Lao People’s Democratic Republic on the use of the cVDPV outbreak response to deliver MRCV. This may have provided many unimmunized children (e.g. Hmong ethnicity) with a first opportunity to be vaccinated against measles and rubella.

- The RVC notes that the number of reported cases is inconsistent with the reported immunization coverage and raises concern about possible gaps in surveillance sensitivity. In addition, the RVC notes with concern the low performance of several laboratory surveillance indicators.

- The RVC applauds the planned introduction of a routine second dose of MRCV into the NIP.

3.1.9 Conclusions for Macao SAR (China)

- The RVC verifies that Macao SAR (China) has sustained the interruption of endemic measles virus circulation.

- The RVC appreciates the commitment of Macao SAR (China) to rubella elimination and notes that it may have already achieved interruption of endemic rubella virus transmission and would welcome a detailed progress report along the five lines of evidence, once the NVC determines that evidence supports the elimination criteria.

- The RVC welcomes the inclusion of rubella in the annual serological survey from 2017.
The RVC acknowledges with appreciation that specific strategies for targeting the adult migrant workforce will be addressed by the NVC.

The RVC appreciates the description of two detected rubella cases, which provides reassurance that surveillance is functioning.

3.1.10 Conclusions for Malaysia

- The RVC appreciates the high-quality progress report submitted this year, which demonstrates the engagement of the NVC in the measles and rubella elimination effort.
- The RVC acknowledges that Malaysia has appropriately changed the national immunization schedule based on a review of measles epidemiology.
- The RVC appreciates that a nationwide coverage survey was conducted confirming the immunity resulting from reported two-dose coverage among the resident population; however, it notes that unregistered children are unlikely to benefit from current routine immunization strategies including the school check. The RVC notes that geographical areas, including Sabah, with mobile and undocumented populations will need special attention to ensure no one is left behind.
- The RVC endorses Malaysia’s planned SIA in 2017 that particularly targets hard-to-reach populations.

3.1.11 Conclusions for Mongolia

- The RVC congratulates Mongolia on the high coverage of the national wide age-range SIA targeting young adults and notes that measles case counts have decreased dramatically.
- The RVC appreciates that substantial effort was invested by Mongolia in investigating the extended measles outbreak to understand risk factors and opportunities for programmatic strengthening. The RVC gratefully acknowledges that valuable lessons for the country and the Region have been gained from Mongolia’s pioneering steps towards measles elimination.
- The RVC congratulates Mongolia for planning to re-establish CRS surveillance.
- The RVC notes that the post-verification report format submitted this year presents an inadequate level of detail to understand the epidemiological situation and programme strengths and weaknesses of Mongolia following re-establishment of endemic measles transmission.

3.1.12 Conclusions for New Zealand

- The RVC verifies that New Zealand has achieved the interruption of endemic measles and rubella virus transmission for a period of at least 36 months in the presence of high-quality surveillance and supporting genotype evidence, and congratulates the country for this achievement.
- The RVC notes that despite having interrupted transmission of endemic measles and rubella, significant immunity gaps remain among demographic and geographic risk groups in New Zealand, in particular older adolescents and young adults, and the Maori population. The RVC further expresses concern that unless urgent action is taken to fill these immunity gaps, New Zealand will be at risk of measles and rubella outbreaks, as well as the occurrence of CRS following importation.
- The RVC acknowledges the programmatic challenges of achieving high coverage of immunization directed at young adults, but notes that the significant population of measles and rubella-susceptible older adolescents attending high school could still be reached and protected by vaccination.
- The RVC congratulates New Zealand on planning a Measles and Rubella Elimination Symposium, which demonstrates its commitment to identifying and proactively addressing...
the programmatic and epidemiologic threats to sustaining its status as having eliminated measles and rubella.

### 3.1.13 Conclusions for Pacific island countries and areas

- The RVC acknowledges the progress towards interruption of endemic measles and rubella transmission in the PICs, and some improvements in surveillance and immunization coverage in individual PICs.
- The RVC notes the gradual improvement in epidemiologic and laboratory surveillance over time while noting that surveillance sensitivity varies.
- The population immunity in PICs needs to be further improved to prevent large future outbreaks of measles and rubella.
- The RVC notes that given the high cost of outbreak response immunization campaigns, an outbreak response plan to guide case investigation and confirmation is needed to strengthen PICs’ capacity to recognize and respond quickly to imported cases and limit spread among populations with low immunity.
- The RVC notes that Fiji has an existing surveillance programme for congenital malformations and encourages PICs to build on this system to conduct CRS surveillance.
- The RVC advises that when the SRVC assesses that the PICs have reached an appropriate moment to request verification of elimination, the RVC will expect to see evidence of considerable improvements in coverage, a well-defined plan for outbreak investigation and emergency response, and a level of surveillance that is adequate to rapidly identify outbreaks and detect endemic transmission if it were occurring.

### 3.1.14 Conclusions for Papua New Guinea

- The RVC appreciates the efforts of the NVC in producing the report, but notes with grave concern the apparent limited support being provided to the NVC, and the dated information included in the report that is of little current relevance.
- Papua New Guinea should take urgent measures to avert a large outbreak of measles and rubella in coming years, which will result in substantial morbidity and mortality, if population immunity is not improved.
- The RVC is disappointed to note the decrease in administrative immunization coverage in 2016.
- The RVC notes with concern the very low number of suspected cases that were reported, suggesting substantial weaknesses in surveillance.

### 3.1.15 Conclusions for the Philippines

- The RVC notes with concern the rubella cases occurring among adolescents and young adults, and the corresponding increase in CRS cases that can be expected.
- The RVC notes the decrease in reported measles cases in 2016 compared to 2015; however, it emphasizes that the normal epidemiology of endemic measles, particularly following large outbreaks, can include periods of very low incidence, and that incidence of less than one per million is not the standard for achieving elimination.
- The RVC notes with concern the large MR immunity gaps and supports the conclusions of the NVC that the “MCV1 and MCV2 coverage for 2016 is dismal” and is “an ominous sign that a large outbreak may occur soon”.
- The RVC applauds the engagement of the education sector to increase immunization coverage among school-age children, but notes that performance of the school-based immunization programme is highly variable, and the reach of the programme is unclear.
• The RVC expresses concern that vaccine stock-outs have occurred, which are a significant barrier to achieving high coverage.

• The RVC notes that it is imperative that adequate vaccine stocks are in place to meet increased demand before initiating outreach or social mobilization campaigns.

3.1.16 Conclusions for the Republic of Korea

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

• The RVC also verifies that the Republic of Korea has achieved the interruption of rubella virus transmission for a period of at least 36 months in the presence of high-quality surveillance and supporting genotype evidence, and congratulates the country for this achievement.

• The RVC congratulates the Republic of Korea on the high standard of NVC progress reports on both measles and rubella elimination.

3.1.17 Conclusions for Singapore

• The RVC congratulates Singapore on maintaining sufficient population immunity to avoid large sustained outbreaks despite frequent importations of measles virus from endemic countries.

• The RVC appreciates that Singapore’s submission of genotype evidence provides supportive evidence that clusters of detected measles cases are unrelated; but notes that further description of the sequences to identify measles lineage would provide greater confidence that case clusters with frequently reported genotypes such as D8 and D9 are due to unrelated importations.

• The RVC notes Singapore’s efforts to increase second-dose coverage, which would be necessary to achieve and sustain elimination.

• The RVC notes that Singapore may have already achieved interruption of endemic measles 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.

3.1.18 Conclusions for Viet Nam

• The RVC notes that despite the small number of reported measles cases, limited epidemiological description was provided and no genotype data are presented to help determine whether these cases are sporadic or clusters.

• The RVC raises concern that the low number of reported cases, lack of secondary transmission, and the surprisingly low number of cases reported from border regions of Viet Nam seem to be inconsistent with the numbers of Viet Nam-imported cases reported from neighbouring countries and further afield internationally. The RVC notes that there may be significant surveillance weaknesses leading to under-reporting of measles cases in Viet Nam.

• The RVC notes the timing of the planned 2017 surveillance review and would stress that this presents a critical opportunity to fully explore weaknesses in case identification, investigation, and reporting, to guide programmatic strengthening.

3.2 Recommendations

3.2.1 Recommendations for Member States

General recommendations

1. The RVC requests that all NVCs include a summary of specific actions taken in response to previous RVC recommendations in their annual reports.
2. The RVC requests that NVCs submit a progress report that separately details the five lines of evidence of progress to elimination of both measles and rubella, so that an independent assessment can be made for each disease.

3. The RVC requests that countries that have been verified as having interrupted endemic measles and/or rubella transmission submit an annual progress report that strictly adheres to the revised post-verification report format for the specific viral disease (measles and/or rubella) interrupted, which will be finalized by the RVC following consultation with measles- and/or rubella-interrupted countries. This post-verification format should be used only to report on the disease with sustained interruption. If endemic transmission of measles or rubella has been re-established following interruption, a complete pre-verification report must be submitted.

4. The RVC recommends that generally following re-establishment of endemic transmission, countries demonstrate 36 months of interruption before requesting verification to provide epidemiological reassurance that ongoing endemic transmission is not continuing undetected.

5. The RVC recommends that NVCs attach, as appendixes to annual progress reports, any relevant published manuscripts describing or analysing progress towards/maintenance of measles and rubella elimination, including results of vaccination coverage surveys, outbreak investigations and serosurveys. When reporting results of serosurveys, description of the year of the survey, sample size, selection criteria, representativeness, testing methods and cut-offs for positive immunity should be included.

6. The RVC recommends that post-elimination countries clearly define a case-confirmation algorithm (including laboratory methods), and identify individuals with expertise needed to review all suspected cases and make determination of case confirmation status during an ongoing (multiple generations) outbreak; this case-confirmation algorithm and composition of the expert committee (which could be at national or subnational level where expertise permits) should be defined as part of a written national outbreak response plan.

7. The RVC requests that when providing post-verification progress reports for measles and/or rubella, NVCs present data describing epidemiological and genotype details for all cases, both outbreak-associated and sporadic, and with both known and unknown sources.

8. The RVC requests that post-verification progress reports include summary outbreak descriptions that include epidemiological profile, risk factors and genotype.

9. The RVC recommends that countries and areas take necessary steps to strengthen measles and rubella surveillance in order to be able to detect and implement effective response measures to measles or rubella virus importation/transmission in a timely way.

10. The RVC encourages sharing of information on international introductions of measles cases, including genotype data, through the IHR mechanism.

11. The RVC urges countries and areas to explore opportunities and strategies for collaborating with neighbouring countries on cross-border surveillance and vaccination activities targeting mobile, transient or cross-border populations.

12. The RVC urges that, in order to achieve measles and rubella elimination, Member States develop a plan for high-quality surveillance and immunization programmes that include all individuals regardless of their residence or documentation status.

13. The RVC recommends that all countries and areas take necessary actions to remove barriers to vaccination for all persons, including internal and external migrants and mobile populations.

14. The RVC recommends measles and rubella vaccination for all children who do not have two documented doses even if outside the usual age for vaccination.

15. The RVC recommends that activities to increase the scope of EPI, including introduction of new and underutilized vaccines and/or the integration of other health services, be carefully planned and performed so that they enhance (rather than compromise) the programme’s
capacity to deliver vaccines already included in NIPs to fill immunity gaps and improve access to unvaccinated individuals.

16. The RVC urges countries and areas to engage neighbouring countries and areas to further increase information exchange and coordination for cross-border outbreak investigation and immunization activities, to leverage combined resources to reduce the risk of undetected importations, and to protect transient or cross-border communities that may be routinely missed by their respective immunization programmes.

Recommendations for Australia
1. The RVC recommends that Australia continue to maintain sensitive epidemiological and laboratory surveillance, and achieve high routine vaccination coverage for MRCV.
2. The RVC recommends that any future serological surveys use only internationally referenced and validated laboratory methods to facilitate broad comparability of findings with other studies.

Recommendations for Brunei Darussalam
1. The RVC recommends that Brunei Darussalam continue to maintain sensitive epidemiological and laboratory surveillance, and achieve high routine vaccination coverage for MRCV.
2. Noting the high number of students arriving from measles endemic countries, the RVC encourages Brunei Darussalam to identify lessons from the recent importation and consider potential interventions to ensure incoming students are protected against, and are not a source of, measles.
3. The RVC reminds the NVC of the expectation that they meet at least annually to review and certify the information presented in the annual progress report.

Recommendations for Cambodia
1. The RVC encourages Cambodia to continue to maintain sensitive epidemiological and laboratory surveillance, and further strengthen the routine immunization system to achieve and sustain high immunity in all populations using two doses of MR vaccine throughout the country and thus reduce reliance on SIAs to protect the population and prevent outbreaks.
2. The RVC encourages further action to strengthen the country’s capacity to rapidly identify and investigate future measles outbreaks so that a detailed description can be provided of the epidemiology, transmission pathways, source of infection and genotype (emphasizing the importance of collecting high-quality virologic specimens, including throat swabs, during case investigation).
3. The RVC encourages Cambodia to identify the vaccine-target population more precisely to vaccinate all the vaccination eligible children, which will improve the quality of numerator and denominator data from routine and supplemental immunization programmes to enable accurate calculation of immunization coverage in all provinces.
4. The RVC encourages Cambodia to explore opportunities to combine the planned future Demographic and Health Survey or other representative surveys with a serological survey to better understand population immunity and identify specific groups in need of targeted immunization activities.
5. The RVC encourages Cambodia to explore opportunities and strategies for strengthening collaboration with neighbouring countries on cross-border vaccination activities targeting mobile, transient or cross-border populations.
6. The RVC urges Cambodia to strengthen hospital infection control policies and practices to prevent health-care facilities from amplifying measles and rubella outbreaks; these policies should include requiring health-care providers to document measles and rubella immunity, protecting exposed contacts within public and private hospitals by effectively isolating...
suspected measles and rubella cases, as well as ensuring that outbreak investigation teams can perform investigations in all health-care facilities.

**Recommendations for China**

1. The RVC endorses the strategies to improve surveillance and better understand population immunity that are described in the progress report, including: integrating rubella testing into existing nationwide birth defect surveillance systems as recommended by the international measles and rubella joint consultation; and the NVC recommendation to work with the Ministry of Education to strengthen and standardize school vaccination check (and link to catch-up vaccination doses).

2. The RVC endorses the strategies to raise population immunity that are described in the progress report, including: fully implementing the school vaccination check and vaccination programmes as recommended by the NVC; urgently acting to close the immunity gap while adolescents are still reachable through school-based programmes (particularly for rubella); and targeted adult vaccination campaigns in some provinces to fill immunity gaps in a focused way.

3. The RVC recommends that the China National Immunization Technical Advisory Group (NITAG) consider looking for opportunities to simplify the current immunization schedule to reduce the number of health facility visits needed.

4. The RVC recommends that the China NITAG issue clear evidence-based guidance on contraindications to vaccination.

5. The RVC recommends that China consider sharing “best practices” from high-performing provinces so that they can be applied to other provinces with similar challenges.

6. The RVC recommends that China develop or update national policies and standardized protocols for outbreak investigation; and use outbreak investigation as an opportunity to immunize adults by delivering MR vaccination to contacts or risk groups.

7. The RVC recommends that China strengthen collaboration with neighbouring countries on cross-border surveillance and vaccination activities targeting mobile, transient or cross-border populations.

8. The RVC recommends that China strengthen hospital infection control policies to prevent health-care-associated measles and rubella transmission.

**Recommendations for Hong Kong SAR (China)**

1. The RVC recommends that Hong Kong SAR (China) continue to maintain sensitive epidemiological and laboratory surveillance, and achieve high routine vaccination coverage for MRCV.

2. The RVC continues to recommend that Hong Kong SAR (China) strengthen health-care worker vaccination and health facility infection control practices to reduce the risk of outbreaks occurring in healthcare facilities.

3. The RVC requests that the next NVC report include genotype details from all cases of measles and rubella (in addition to outbreaks), as these data would provide further supportive evidence that detected cases are due to multiple importations from different sources.

**Recommendations for Japan**

1. The RVC encourages Japan to continue sharing its valuable experience from outbreak analyses and response and include these descriptions as annexes in the annual progress report.

2. The RVC requests further information in the next progress report to clarify whether the very high MR discard rate is due to high clinical suspicion and reporting, or due to a targeted screening programme or another explanation.
**Recommendations for the Lao People’s Democratic Republic**

1. The RVC recommends that the Lao People’s Democratic Republic implement recommendations from the 2015 VPD surveillance review conducted together with WHO.

2. The RVC encourages the country to monitor and improve laboratory indicators, for example proportion of adequate specimens for genotype, particularly during outbreaks.

3. The RVC encourages the country to build on the improved access to people in remote areas, including the Hmong ethnic group, and acceptance of immunization that resulted from the polio outreach activities in 2016 and 2017, to continue to deliver vaccination services and conduct thorough and timely case investigation.

4. The RVC urges the Lao People’s Democratic Republic to engage with neighbouring countries to further increase information exchange and coordination of cross-border outbreak investigation and immunization activities, to leverage combined resources to reduce the risk of undetected importations, and to protect transient or cross-border communities that may routinely be missed by the immunization programmes.

**Recommendations for Macao SAR (China)**

1. The RVC recommends that Macao SAR (China) continue to maintain sensitive epidemiological and laboratory surveillance, and achieve high routine vaccination coverage for MRCV.

2. The RVC encourages Macao SAR (China) to report genotypes of all detected cases, and to continue efforts to obtain virologic specimens from all cases.

3. The RVC encourages Macao SAR (China) to report “uncorrected” immunization coverage (including in the denominator the children of both permanent and transient residents) as well as “corrected” coverage.

4. The RVC notes that Macao 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.

**Recommendations for Malaysia**

1. The RVC recommends that Malaysia continue to work to improve MRCV1 and MRCV2 coverage in order to achieve elimination.

2. The RVC encourages the NVC to describe efforts to reach, and improve immunity among mobile and undocumented populations and groups with vaccine hesitancy, and to report immunization coverage and surveillance performance with denominators that also include undocumented communities.

3. The RVC requests the NVC to submit a description of its newly developed outbreak response plan and procedures in next year’s report.

4. The RVC notes the value of producing a phylogenetic tree to display measles sequences, and the RVC encourages Malaysia to continue to provide detailed molecular descriptions and mapping.

5. The RVC is encouraged by the strengthening of school-based immunization checks, following the NITAG’s recommendation, and strongly endorses sustained implementation of this strategy.

6. Malaysia is encouraged to develop and describe policies to ensure immunity of populations in settings at risk of outbreaks, in particular in prisons and health-care facilities.

7. The RVC recommends Malaysia consider working with nongovernmental organizations to reach undocumented populations to ensure cases in these populations are captured by surveillance and that vaccine is delivered to these individuals.

8. The RVC suggests developing strategies to ensure immunization of migrant workers as this large community can introduce and spread measles.
Recommendations for Mongolia

1. The RVC requests Mongolia to submit a full report on progress to measles elimination that includes a detailed epidemiological description of the 2016–2017 outbreak, including results of epidemiologic studies and programme assessments that were conducted in response, and results of the nationwide serological survey conducted in 2016. The RVC welcomes the submission of published studies on the outbreak that may have resulted as supportive information.

2. The RVC requests a description of any policy changes or programmatic actions planned to address the population immunity gaps or programmatic weaknesses that were identified by the outbreak investigation and associated studies.

3. The RVC encourages the NVC to build on community awareness of measles as a public health threat that resulted from the recent multi-year measles outbreak, to advocate visibility of measles and rubella elimination efforts in Mongolia.

Recommendations for New Zealand

1. The RVC recommends that New Zealand continue to maintain sensitive epidemiological and laboratory surveillance, and achieve high routine vaccination coverage for MRCV.

2. New Zealand is encouraged to actively close the immunity gaps clearly demonstrated by the median number of generations of previous outbreaks, profile of outbreak cases and serosurveillance data. For Maori communities, this work could build on lessons from previous public health programmes that effectively reached Maori communities, to ensure optimal coverage in these communities.

3. The RVC recommends that New Zealand consider capitalizing on the strength of its NIR and the relatively accessible population of older adolescents attending high school to conduct school-based selective catch-up immunization activities to close the measles and rubella immunity gap in this population.

4. The RVC recommends that New Zealand coordinate and facilitate data reporting from other major testing laboratories in the country to the national measles and rubella laboratory, to obtain and report information on the number of measles/rubella tests performed throughout the country.

Recommendations for Pacific island countries and areas

1. The RVC endorses the programmatic recommendations of the SRVC.

2. The RVC recommends that the SRVC formally engage with Australia and New Zealand to establish data sharing procedures and policies regarding Pacific islanders with measles or rubella that are detected in those countries.

3. The RVC endorses the SRVC call for a subregional strategy and plan of action to guide measles and rubella elimination efforts.

4. The RVC recommends that each country develop outbreak investigation and emergency response plans, informed by the existing subregional outbreak response guidelines, and conduct exercises to test those plans.

5. The RVC encourages PICs to leverage existing syndromic surveillance systems for fever and rash to supplement current surveillance for measles and rubella cases, and to build on existing surveillance systems for congenital malformations to conduct CRS surveillance.

Recommendations for Papua New Guinea

1. The RVC urges Papua New Guinea to provide resources needed for the critical activities of the NVC.

2. The RVC urges Papua New Guinea to increase resources to strengthen and sustain the routine immunization system throughout the country, raise coverage of routine MRCV, and enhance the performance of the Special Integrated Routine EPI Strengthening Program (SIREP) to
prevent large outbreaks of measles and rubella. Examples of better practices in higher-performing areas could be used to incrementally improve performance across the country.

3. The RVC encourages Papua New Guinea to identify and support those parts of the country that have demonstrated a commitment and capacity to investigate and report suspected measles and rubella cases.

4. The RVC encourages Papua New Guinea to strengthen epidemiologic and laboratory surveillance and case investigation for early detection and response to outbreaks, which will have broad benefits for health security.

5. The RVC requests that Papua New Guinea replace dated survey information with more recent assessments, including results of the ongoing Demographic and Health Survey.

Recommendations for the Philippines

1. The RVC urges the Philippines to prioritize their planned immunization initiatives to maximize effectiveness in closing measles and rubella immunity gaps to avert a future large measles outbreak with high mortality, or catastrophic CRS epidemic.

2. The RVC recommends that the Philippines consider prioritizing efforts to deliver high and equitable vaccination coverage with existing vaccines in the national programme, including when introducing new vaccines, and ensure that any introduction of new vaccines are used to opportunistically deliver MR vaccine.

3. The RVC recommends that the Philippines further strengthen the school-based catch-up immunization initiative. To increase the impact of this programme and help decrease the immunity gap among adolescents, the Philippines should consider implementing a school exit vaccination check targeting graduating high school students and provide another immunization opportunity.

4. The RVC recommends that the Philippines engage with other government departments, such as those involved in labour or immigration targeting the overseas workforce, as well as other civil society groups, including religious denominations, paediatric societies and others, to vaccinate or create demand nationwide and particularly among difficult-to-reach or high-risk populations.

5. The RVC encourages the Philippines to fully implement the Reaching Every Purok initiative and pursue further efforts to identify and reach unvaccinated individuals. The RVC recommends conducting a Purok-level risk assessment to guide these efforts.

6. The RVC recommends that the Philippines conduct activities such as retrospective case review in the coming months in order to assess the burden of CRS resulting from continuing transmission of rubella among adolescents and young adults. Additionally, the RVC recommends that the Philippines consider establishing a prospective sentinel CRS surveillance system, which would be valuable to measure the impact of efforts to improve rubella vaccination coverage.

7. The RVC recommends that the Philippines incrementally expand surveillance for measles and rubella beyond inpatient service at the hospital level, to include all public and private hospitals to improve sensitivity to detect and characterize outbreaks.

8. The RVC urges the Philippines to increase resources to strengthen and sustain the routine immunization system throughout the country, and raise coverage of routine MRCV to prevent large outbreaks of measles and rubella. Examples of better practices in higher-performing areas could be used to incrementally improve performance across the country.

9. The RVC recommends that the Philippines explore opportunities to leverage existing syndromic surveillance (e.g. for dengue or Zika) to detect trends that could trigger testing for measles and rubella cases.
Recommendations for the Republic of Korea

1. The RVC recommends that the Republic of Korea continue to maintain sensitive epidemiological and laboratory surveillance, and achieve high routine vaccination coverage for MRCV.

2. The RVC recommends that the Republic of Korea provide genotype data on all identified cases of measles and rubella. A detailed epidemiological description would provide further insight into the source of importations as well as immunity gaps and transmission patterns when secondary transmission occurs.

3. The RVC looks forward to learning the results of the planned 2018 national serosurvey.

4. The RVC encourages the Republic of Korea to monitor certain rubella laboratory surveillance performance indicators: “% of specimens received at laboratory within 5 days of collection” and “% specimens with results within 4 days of arrival at the laboratory”, “% virus detection and genotype completed within 2 months of receipt”; and in particular, to provide the exact dates of specimen collection, transportation and reporting for rubella testing.

Recommendations for Singapore

1. The RVC encourages Singapore to continue efforts to improve second-dose coverage and to report the impact of school checks on closing the second-dose coverage gap.

2. The RVC requests that Singapore report cases according to the standard WHO case definitions of “imported”, “import-related” or “unknown source”, and not use the non-standard “local” designation, which presents challenges for interpretation.

3. The RVC suggests that a serosurvey, reported by birth cohort, may be useful to identify current immunity gaps.

4. The RVC encourages Singapore to strengthen case investigation capacity to better describe the epidemiology and vaccination status of cases, and to further reduce the number of cases with unknown source.

5. The RVC encourages Singapore to prioritize obtaining genotype information from as many detected measles cases as possible, and to report detailed sequence information that can be used to further discriminate independent import-related clusters.

6. The RVC requests Singapore to present a detailed description of the algorithm (including laboratory testing) and all data used to determine case confirmation status, in the next progress report.

7. The RVC requests Singapore to adopt and implement parallel or sequential testing for measles and rubella for all suspected cases of measles or rubella, and provide a unified discard rate to report non-measles, non-rubella febrile rash illness.

8. The RVC encourages Singapore to describe any activities planned to assess and ensure measles and rubella immunity in the foreign workforce.

Recommendations for Viet Nam

1. The RVC requests Viet Nam to provide a description of the policies and strategies for investigating and reporting measles and rubella cases at national and subnational level to describe source of exposure, identify unreported cases and protect exposed contacts.

2. The RVC recommends that Viet Nam continue to conduct SIAs until the 95% coverage targets for routine immunization with two doses of MRCV are met in all provinces.

3. The RVC urges Viet Nam to create opportunities to target adolescents and young adults for supplementary or catch-up MR vaccination, to reduce the immunity gap among this population and prevent a large increase in CRS cases due to outbreaks among women of childbearing age.

4. RVC urges Viet Nam to strengthen case investigation and laboratory capacity, including increased efforts to obtain genotype data.
3.2.2 Recommendations for WHO

1. The RVC requests that WHO present an annual report to the RVC on their progress in implementing the recommendations from the preceding RVC meeting.

2. The RVC recommends that WHO appoint an experienced rubella epidemiologist to the RVC to strengthen the commission’s rubella-specific capacity and further guide the rubella elimination effort in the Region.

3. The RVC recommends that WHO headquarters use lessons learnt in post-elimination settings in the Western Pacific Region in creating global guidance for both the new VPD surveillance standards and the updated verification framework.

4. The RVC recommends that WHO specifically request and support pre-elimination countries to fully describe the design and extent of their case-based surveillance systems in terms of population covered, representativeness and sources of case reporting.

5. The RVC recommends that WHO provide specific guidance to countries about effective options and standard guidance on indicators to implement CRS surveillance to support rubella elimination. It may be useful to consult with the International Network of Paediatric Surveillance Units (INoPSU) about the potential for this approach to be used more widely in the Region for CRS surveillance.

6. The RVC requests WHO to continue to support countries in developing measles/rubella - specific outbreak preparedness and response plans.

7. The RVC recommends that WHO and partners continue to support countries to conduct measles and rubella risk assessments.

8. The RVC encourages the WHO Regional Office for the Western Pacific to continue supporting biregional and cross-border collaboration in information sharing and joint programme initiatives with the WHO Regional Office for South-East Asia and WHO Regional Office for Europe.

9. The RVC recommends that WHO continue to provide support to enhance surveillance and immunization efforts in outbreak-affected and neighbouring countries and areas.

10. The RVC recommends that WHO provide technical support to countries and areas to improve accuracy of vaccination coverage estimates.

11. The RVC requests WHO to finalize and distribute guidance to countries and areas on conducting quality serosurveys.

12. The RVC recommends that WHO continue supporting countries and areas that do not regularly report genotype data to obtain adequate genotype data and to develop a standard format to present the genotype data so that the RVC can make informed determinations about importations, outbreaks and mapping chains of transmission. Country reports should include genotypes from sporadic and outbreak associated cases.

13. The RVC recommends that WHO support selected NVCs with the preparation of their annual progress reports.

14. The RVC recommends that WHO and partners continue to support important operational research to guide national measles elimination efforts.

15. The RVC recommends that WHO present recent measles outbreaks including epidemiological and laboratory features to the SAGE Measles Rubella Working Group for review and consideration about potential impacts on global policy.

16. The RVC recommends that WHO and partners provide technical and financial support to strengthen Cambodia’s surveillance and outbreak response capacity, and work with Cambodia to explore reasons underlying issues of numerator and denominator data quality during the upcoming EPI review and support improved data quality.
17. The RVC recommends that WHO and partners work with Singapore to clarify the algorithms and procedures used to assign case classification status and identification of source for measles and rubella cases.

18. The RVC recommends that WHO and partners work with the Philippines to improve coverage and performance of case-based measles and rubella surveillance, and to leverage existing syndromic surveillance programmes to monitor trends in incidence of possible measles and rubella cases.

19. The RVC recommends that WHO support the SRVC in advocating measles and rubella elimination in the PICs.

20. The RVC requests WHO and partners to strengthen technical support provided to Papua New Guinea to ensure potent vaccine is delivered and administered to all communities.
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## TIMETABLE

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<th>Time</th>
<th>Tuesday, 12 September 2017</th>
<th>Time</th>
<th>Wednesday, 13 September 2017</th>
<th>Time</th>
<th>Thursday, 14 September 2017</th>
<th>Time</th>
<th>Friday, 15 September 2016</th>
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<tbody>
<tr>
<td>08:00–08:30</td>
<td>REGISTRATION</td>
<td>08:00–08:30</td>
<td>Review recommendations from Day 1</td>
<td>08:00–08:30</td>
<td>Review recommendations from Day 2</td>
<td>08:00–08:30</td>
<td>Review recommendations from Day 3</td>
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<tr>
<td>08:30–09:00</td>
<td>Opening Session</td>
<td>08:30–09:15</td>
<td>6. Report from Hong Kong SAR (China)</td>
<td>08:30–09:15</td>
<td>13. Report from Viet Nam</td>
<td>08:30–09:30</td>
<td>20. Preparation for the meeting with</td>
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<td></td>
<td>Opening remarks</td>
<td></td>
<td>• Draft recommendations for</td>
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<td>• Draft recommendations for</td>
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<td>National Health and Family Planning</td>
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<td></td>
<td>• Self-introduction</td>
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<td>Hong Kong SAR (China)</td>
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<td>Viet Nam</td>
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<td>Commission (NHFPC), National</td>
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<td>• Administrative announcements</td>
<td>09:15–09:40</td>
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<td>09:15–09:40</td>
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<td>Verification Committee (NVC) China</td>
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<td>09:00–09:30</td>
<td>GROUP PHOTO AND COFFEE BREAK</td>
<td>09:40–10:10</td>
<td>COFFEE BREAK</td>
<td>09:40–10:10</td>
<td>COFFEE BREAK</td>
<td>09:30–10:00</td>
<td>COFFEE BREAK</td>
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<td></td>
<td>2.1. Meeting objectives</td>
<td>10:40–11:05</td>
<td>• Draft recommendations Mongolia</td>
<td>10:40–11:05</td>
<td>• Draft recommendations for Malaysia</td>
<td>10:00–10:20</td>
<td>Guidelines” and “Post-Verification</td>
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<td></td>
<td>rubella elimination</td>
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<td>• Draft recommendations for</td>
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<td>• Draft recommendations for</td>
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<td>21.1. Discussion on “Verification</td>
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<td>Australia</td>
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<td>Philippines</td>
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<td>Guidelines”</td>
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<td>2.3. Verification Commissions for</td>
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<td>21.2. Discussion on “Post-Verification</td>
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<td>Country Annual Report”</td>
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<td>other regions</td>
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<td>10:35–10:50</td>
<td>2.5. Virologic surveillance of measles and rubella in the Western Pacific Region, 2016–2017</td>
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<td>10:50–11:05</td>
<td>2.6. Verification of rubella elimination: similarity to and</td>
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<tr>
<th>Time</th>
<th>Session</th>
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<tr>
<td>11:05–11:15</td>
<td>Discussion</td>
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<td>12:15–13:15</td>
<td>LUNCH BREAK</td>
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<tr>
<td>13:00–13:30</td>
<td>Draft recommendations for New Zealand</td>
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<td>13:30–13:55</td>
<td>Draft recommendations for Korea</td>
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<tr>
<td>13:45–14:15</td>
<td>5. Report from Cambodia</td>
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<tr>
<td>14:00–14:25</td>
<td>Analysis of measles outbreak in Cambodia 2016–2017</td>
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<td>14:25–14:50</td>
<td>Presentation of five lines of evidence and missing data</td>
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<td>14:50–15:20</td>
<td>Draft recommendations for Cambodia</td>
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<td>15:00–15:30</td>
<td>Regional Director's reception</td>
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<td>15:30–16:00</td>
<td>6. Report from Cambodia</td>
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<td>16:15–16:45</td>
<td>Draft recommendations for Lao People's Democratic Republic</td>
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<td>16:00–17:00</td>
<td>7. Report from Lao People's Democratic Republic</td>
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<td>16:45–17:10</td>
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<td>17:00–17:30</td>
<td>8. Report from Brunei Darussalam</td>
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<td>18:00–19:00</td>
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<td>19:00–20:00</td>
<td>Report from Cambodia</td>
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<tr>
<td>20:00–21:00</td>
<td>Draft recommendations for Cambodia</td>
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<tr>
<td>21:00–22:00</td>
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