Measles and Rubella Regional Progress Updates

Contents

1 AFRICAN Region

1.1 Regional control and/or elimination targets

a) Measles elimination target 2020

b) Rubella target : No regional target set

Comment

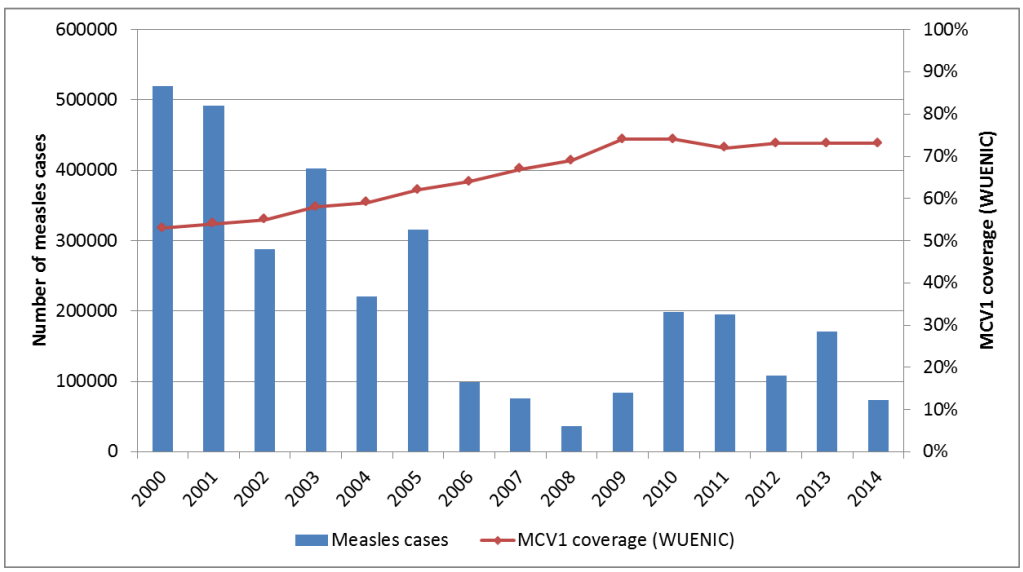
In 2001 the region launched mortality reduction activities. Subsequently, in 2011, Resolution AFR/RC61/4/(2011).was adopted for measles elimination for 2020.

Although there was no target date set for rubella elimination, countries are introducing rubella containing vaccines in their programs and conducting surveillance for rubella and congenital rubella syndrome.

1.2 Summary of progress towards regional targets

1. In 2014, only 14 countries maintained the indicator of MCV1 of 90% or more coverage. The number of countries achieving coverage of 90% or more increased from 4 in 2000 to 16 in 2009. This period also showed a significant increase in MCV1 coverage between 2001 and 2009 (53% to 74%) This has however stagnated around 73-76% since 2009.
2. There has been a more than 90% decline of reported cases of measles case reports since 2000 (from over 500,000 to under 50,000 in 2008). However, a sharp increase occurred between 2010 and 2011 due to outbreaks , especially in Southern African countries mainly due to spread among susceptible order age groups.
3. The increases in case reports in 2013 represent large outbreaks that occurred in DR Congo (88,381 cases) and Nigeria (52,852 cases) which represented 83% of the 171,178 cases reported in this year.

Figure 1. African Region measles vaccination coverage (WUENIC) and official case reports, 2000 – 2014

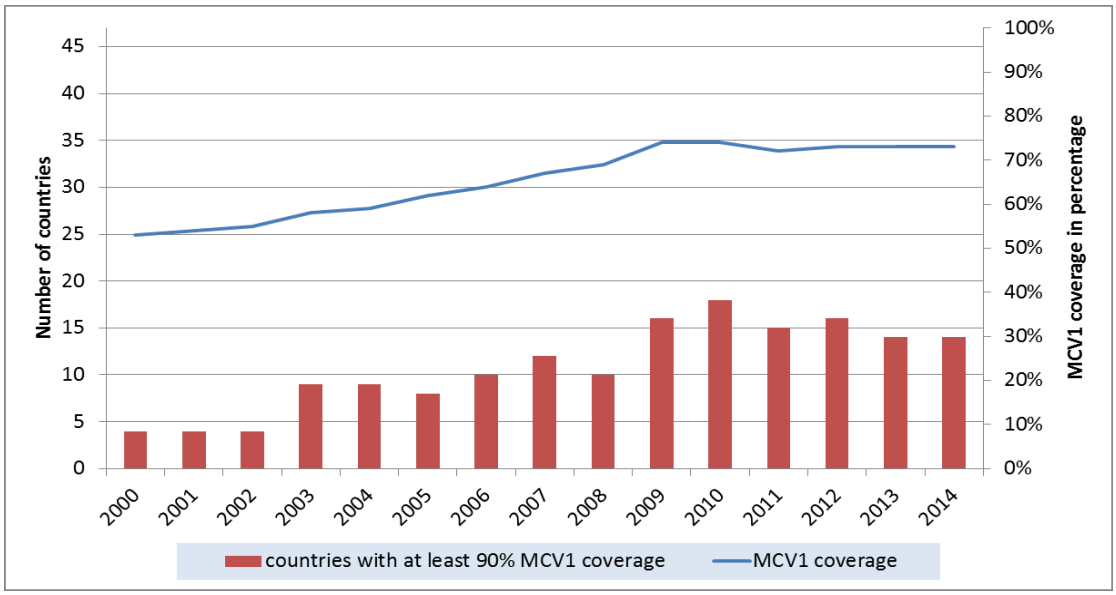


1.3 Summary of implementation of each of the 5 key strategies

a) Achieve and maintain high levels of population immunity with two doses of measles and rubella containing vaccines :

1. As of December 2015, 23 countries had introduced MCV2 in their routine programs (with 4 of these in 2015). Coverage data was available from 16 countries in 2014.
2. Only 9 of 47 (19%) have introduced RCV in their routine immunization program.
3. Three of 31 (9.7%) countries conducting SIAs (2013-2015) achieved coverage (administrative) greater than 95% in every district, and all countries doing SIAs include AEFI and routine immunization strengthening in the training of staff.

Figure 2. African Region MCV1 coverage (WUENIC) and number of countries with >90% coverage, 2000 – 2014



b) Monitoring disease using effective surveillance (Table 2)

1. The proportion of countries with measles incidence of less than 5 per million population was, 23 of 44 (52%) in 2013, 21 of 44 (48%) in 2014 and 25 of 44 (57%) in 2015.
2. Overall, the average incidence (2012-2014) was less than 1 per million in 11 countries, between 1 and 5 million in another 11, between 5 and 9 in 6 countries, between 10 and 49 in 12. Four countries (Ethiopia, Nigeria, Angola, and Namibia) had an average incidence above 50.
3. Fourth-four (44) countries are currently implementing case-based surveillance for measles, which is done alongside laboratory confirmation for both measles and rubella. Field activities are integrated with AFP surveillance.
4. The number of specimens received in the Laboratory Network (2012 -2015) was 29,797, 44,998, 43377 and 41,382.

5. The percentage of suspected cases with adequate blood specimens for the for the years 2011 to 2015 were 91%, 78%, 85% and 82% respectively. The receipt of serology results within 7 days was 79%, 54%,75% and 79%.

Table 1: African Region Measles case-based surveillance performance indicators, 2012-2015

Indicator	2012	2013	2014	2015	Comments
Discarded non-measles rate	3.4%	2.9%	3.0%	2.5%	
% second level units with ≥ 2 discarded cases	N/A	N/A	N/A	N/A	Indicator is not monitored
% Districts with at least one case with blood specimen	84.0%	78.0%	77.0%	82.0%	
% suspected cases with adequate investigation	N/A	N/A	N/A	N/A	Indicator not monitored
% suspected cases with adequate blood specimens	91.0%	78.0%	85.0%	82.0%	
% serology lab results ≤ 4 days of receipt	53.0%	50.0%	47.0%	54.0%	
% serology lab results ≤ 7 days of receipt	79.0%	54.0%	75.0%	79.0%	
Number of specimens received in the AFRO Laboratory Network	29,797	44,998	43,377	41,382	

***Goal 3 : Develop and maintain outbreak preparedness, respond rapidly to outbreaks and manage cases*.**

1. During 2011-2012, large outbreaks occurred in a small number of member states. In 2011, 89% of the outbreak cases were from Chad, DR Nigeria and Zambia. In 2012, 88% were from Angola, Burkina Faso, DR Congo, Ethiopia and Nigeria.
2. Based on outbreak investigations, the primary causes of the 2011 and 2012 outbreaks were an accumulation of susceptible in older children and adolescents, shifting susceptibility towards older age groups and gaps in reaching all children with 2 doses of measles vaccine at national and subnational levels through routine vaccination and periodic follow-up SIAs. As mentioned above, in 2013, the major outbreaks were in DR Congo and Nigeria.
3. Many countries continued to experience measles outbreaks in 2014, with large outbreaks occurring in Angola, Ethiopia, Democratic Republic of the Congo, Nigeria and South Sudan. Outbreaks are mainly the result of stagnating coverage levels, with MCV2 coverage lagging behind MCV1 coverage, and poor quality of SIAs in many countries. Funding gaps also led to countries limiting the age ranges covered by SIAs despite a wider age range being indicated, and delaying MCV2 and RCV introduction owing to uncertainty about future financial commitments.
4. Epidemiological investigation of suspected outbreaks is the norm and countries by and large keep good documentation of the outbreaks and analysis of the findings for program use. Recent reports from outbreaks in 2014 and 2015 reflect this.

Goals 4: Communicate and engage to build public confidence and demand

1. The countries in the region have all subscribed to undertake strong advocacy for, and champion measles elimination, develop advocacy materials, and engage partners and donors through regular meetings to ensure adequate financing for the implementation of the measles elimination strategies.
2. Best practices for SIAs as well as routine immunizations are documented and replicated in the countries as well as being shared through the regional office.
3. However, for many countries, intensity of communication and engagement of the public is seen mainly during SIAs and has not yet become part of routine EPI and health systems strengthening.
4. Systematic documentation is lacking for most countries

Goals 5 : Research and development to support cost effective operations to improve vaccination and diagnostic tools

1. When implementing activities for measles elimination, countries look for strategies to improve performance often by conducting operational research which addresses locally challenging issues.
2. In some countries, collaboration with partners such as academic institutions, medical schools, schools of public health and others. For example, in Ethiopia and Zimbabwe, such institutions were key in conducting outbreak investigations and documenting the key risk factors for the outbreaks. How much these partners are used for advocacy is however variable from country to country.
3. Some key operational research activities conducted, especially during SIAs have provided information on location and characteristics of the un-immunized

populations, the reasons for immunization default, overall quality of immunization services.

4. In addition, operational research activities have led to development of innovative approaches to addressing immunity gaps in underserved populations.

Table 2: Summary of Progress towards Regional Targets

Indicator	Regional Status in 2014	Comment
1. No. (%) of countries with ***MCV1 ≥90% nationally and >80% in all districts.***	14 of 47 (30%) of countries with MCV1 of 90% or more (WUENIC)	Not all countries have submitted district coverage data
2. ***No. (%) of countries with MCV2*** >90% nationally and >80% in all districts.	2 of 16 (12.5%) countries withMCV1 of 90% or more (WUENIC)	
3. ***No (%) of countries with RCV*** in their routine immunization program	9 of 47 (19%) have introduced RCV to date	
4. No. (%) of countries conducting ***SIAs with >95%*** in every district.	3 of 31 (9.7%) countries which did SIAs in 2013 -2015 and reported on detailed data achieved >95% coverage in every district	Coverage data was administrative
5. No. (Proportion) of countries with ***measles incidence*** less than five cases per million populations.	23 of 44 (52%) in 2013 21 of 44 (48%) in 2014 25 of 44 (57%) in 2015	Seychelles, Sao Tome & Principe and Mauritius do not have case-based surveillance
6. Number of ***estimated measles deaths***, the percentage reduction since 2000, and number of deaths averted through vaccination.		Source:
7. Number of ***estimated CRS cases***, the percentage reduction since 2000, and number of cases averted through vaccination	Data not available	
8. No. (%) of priority countries providing ***≥ 50% op costs for SIAs***		
9. No. (%) of MCV ***SIAs that include additional child health interventions***	26 of 35 (74%) SIAs between 2013 – 2015 have included at least one additional child survival intervention	
10. No. (%) of countries conducting ***routine immunization and AEFI training as part of SIA training***	All (100%) countries doing SIAs include AEFI and routine immunization strengthening as part of SIA training	
11. No. (%) of priority countries holding a ***MR surveillance review between 2012-2015***	Regular in-depth or desk surveillance reviews (at least once over a period of 3 years) are conducted in 42 of the 44 (95%) of the countries in the case based surveillance network.	

1.4 Status of the measles Elimination in the African Region

The diverse socio-economic development levels, political structures, health system challenges in the countries of the region influence immunization program performance as well as the ability to achieve the measles elimination goals that have been adopted by member states. The African regional Office has therefore established an operational classification which helps in monitoring progress as well as serving as a guide to the support - both financial and technical- that should be provided (Table 3).

Table 3. Summary of Measles Elimination Status by country Groupings, African Region, 2015

GROUP	Status of Elimination	Countries	Regional Office Priority activities to achieve elimination goals
1.	**Countries with strong programs, sustained very low incidence of measles, nearing measles elimination (12 Countries)**	Algeria, Burkina Faso, Cape Verde, Rwanda, Eritea, Gambia, Mauritius, **,** Senegal, Seychelles, Sao Tome and Principe, Zimbabwe	Increase MCV2 coverage, rubella vaccine introduction, support elimination standard measles and rubella surveillance and increase inter-campaign intervels.
2.	**Countries with immunization coverage gaps or surveillance gaps and on track for elimination (16 countries)**	Benin, Burundi, Botswana, Cameroun, Cote d'Ivoire, Comoros, Peoples Republic of Congo, Lesotho, Madagascar, Malawi, Mauritania, Mozambique, Swaziland, Tanzania, Uganda, Zambia	Introduce MCV2, conduct wider-age-range SIAs. Address surveillance gaps.
3.	**Countries with a variety of program gaps (8 countries)**	Guinea, Kenya, Mali, Namibia South Africa, Togo, Liberia, Sierra Leone.	Introduce MCV2, improve quality of SIAs, conduct wider-age-range SIAs.
4.	**Countries with major challenges, large population, insecurity, high incidence of measles, frequent outbreaks and leadership gaps (11 countries)**	Angola, Cental African Republic, Chad, DR Congo, Ethiopia, Equatorial Guinea, Gabon, Guinea Bissau, Nigeria, South Sudan	Advocate for program ownership, routine immunization program strengthening, high quality SIAs with age groups determined by epidemiologic data.

Successes and failures in applying the 4 basic principles underlying the elimination goals :

Country ownership and sustainability

1. All member states have made a commitment to eliminate measles by 2020. Gaps in ownership and leadership at national level has resulted in inadequate local resource allocation for routine immunization and mobilization for SIAs and often delays in providing national funding leading to inadequate and hasty preparation and implementation of measles SIAs
2. Stakeholders have been clearly identified in the strategic plans for the elimination of measles and rubella. Academic institutions; medical and nursing schools, professional societies, Cell-phone network operators are often fully engaged during SIAs; Their role as advocates for strengthening routine immunization activities is however less clear.
3. National ownership is often reflected in the local or national contributions to supporting MRI activities. In 2014, 12 countries conducted SIAs for measles elimination. The percentage contributions to funding these activities are given in ;Angola (98.4%), Benin (36.5%), B/Faso, (0.26%) Chad (13%), Cote d'Ivoire, DR Congo (8.9%), Liberia, Mali (31.8%), Mauritania (47.2%), South Sudan, Tanzania(1.2%), Togo (21.7%). Very countries meet the set target of 50%.
4. At national level, all countries should in diversify their resource mobilisation base, and develop stronger partnerships for local fundraising and advocacy in the efforts towards measles elimination and rubella vaccine introduction. This should however be done in the context of Immunization as part of health systems strengthening and the health security umbrella.

Routine immunization and Health systems strengthening

1. Countries in the region are moving forward with establishing a visit during the second year of life integrating MCV2 and other child health interventions.
2. Where as many countries have the mechanism in place to use MTR activities as an entry point for health systems strengthening, the focus at the moment is more on activities such as planning for SIAs and immediate interventions. There seems to be limited documentation that these opportunities are used for long-term planning for strengthening immunization systems and local commitment for support for immunization. Efforts for fundraising for activities tend to focus on donors and not local resources.
3. Most countries still rely on donor funding and support for the implementation of national plans to sustain the gains in measles mortality reduction, and ultimately attain measles elimination by 2020; Unavailability of such funding has led to non-implementation or postponement of critical activities.
4. MRI activities have been implemented in a vertical manner and where it has improved routine immunization activities it has not been a planned effort and there is limited or no data to indicate its role in health systems strengthening as a whole.
5. The strength of the national health systems of countries across the Region was tested by the occurrence of the Ebola outbreak in Western Africa in 2014 – 2015. The fragility of the health systems resulted in routine immunisation services being interrupted for a length of time in the three affected countries. In addition, scheduled SIAs were postponed in these

countries, leading to outbreaks of measles in all three heavily affected countries (Guinea, Liberia and Sierra Leone).

Equity and linkages

1. Measles SIAs, which have been nationwide and often identified and targeted populations or areas that are difficult to reach. As such, have provided a bridge in equity gaps. They have also served as a platform to delivery of a number of integrated interventions including the provision of TT and OPV vaccines, deworming tablets, Vitamin A supplements, distribution of insecticide treated bed nets.
2. The GPEI and the MRI have worked closely in the region to maximize the planned activities and sought out opportunities to integrate activities. For example, whenever there was an SIA for measles, OPV was. In addition measles case based surveillance is implemented integrated with other vaccine preventable disease surveillance activities, and using the infrastructure and staffing of the AFP surveillance system.

Success factors enabling progress

1. The presence of a Regional resolution with a target date for measles elimination, despite challenges in meeting the set milestones, there remains commitment at both regional and country level.
2. The significant reduction in measles burden in nearly all countries that have implemented the recommended strategies, and national efforts to identify reasons for failure and look for remedial measures and willingness to try new strategies (such as expanded age group vaccinations)
3. The availability of funding from GAVI to support SIAs and introduction of MCV2 in routine immunization programs
4. A global partnership through the MRI, which advocates for resources and provides technical guidance and support.
5. A strong case based-surveillance and an extensive laboratory network that are functional and direct elimination activities.

Barriers to achieving the targets

1. Routine MCV1 coverage not improving especially in countries with large populations.
2. Lack of timely local funding for SIAs, which is often a pre-requisite for donor support. In addition, there is lack of adequate partner funding for large population countries (such as Ethiopia) that require wide-age range measles SIAs because of significant epidemiological shifts to older age groups.
3. Limited funding for the measles-rubella surveillance and laboratory network as the countries in the region scale-up to elimination-standard surveillance.
4. Multiple program priorities at country level, such as, new vaccine introduction, polio eradication, local economic factors, insecurity , natural disasters such as drought, which all lead to lower prioritization of MRI activities

5. Heavy dependency of the GPEI program for staffing and activity funding: Polio-funded staffs are primarily located at the country/district level where they perform ad supervise critical MRI activities.

Comments and Recommendations

1. In reviewing the initiative in AFR countries, it is clear that the strategies for measles elimination are appropriate. The failure to meet the set mid-term goals is because of failure to fully implement the strategies. Technical issues, such as improved surveillance, high quality SIAs, better monitoring, can be addressed. However, an enabling environment, with local and national commitment, improved health systems performance and adequate resources will be required.
2. For countries with strong immunization programs, good surveillance and low incidence of measles, the challenge will be meeting the funding requirements to conduct high quality wide age-range SIAs. These SIAs, with the introduction of MCV2 will go a long way in increasing immunity to all children and others who at risk. In addition, these countries need elimination level case based surveillance.
3. The second group of countries (on track for elimination) could easily move into the first category in the coming two to three years, if the initiative can support the introduction of MVC2 and high quality SIAs covering at risk age groups. Priority should be given to addressing sub-national surveillance gaps.
4. The third group of countries is distinct in having larger populations, but with program gaps due to local/national level commitments and competing priorities. These countries will require advocacy at all levels to solicit notional commitment. Locally appropriate and adapted strategies will be essential to address immunity and surveillance gaps. Introduction of MCV2 will be critical.
5. The fourth group is really the one that is of greatest concern and will probably require a review of how the program should best handle the initiative in terms of what to prioritize in the coming two to three years to bring them to a level where a discussion of when elimination can be achieved. These countries will need to receive special attention, close monitoring and the highest level of technical support.
6. Many countries in the region will need to conduct SIAs and the resources for these activities are substantial. Support for all SIAs should be contingent on ability to ensure the highest quality of activity. Minimum set standards for readiness, operational support and field supervision and assessments should be in place. In addition, clear rationale for expanded age groups for SIAs should be established and funding should be based on updated/current epidemiological data.
7. Sustaining and maximizing the infrastructure provided by the Polio Eradication initiative should be a priority for the fourth group of countries as these are the ones that will be most affected over the next 4 years as funding and support for the initiative is reduced. A deliberate effort will be required, with leadership at national and subnational level to be involved in the legacy planning activities.
8. Improving surveillance should be a priority for countries. PEI staffs should be fully engaged in addressing routine EPI and surveillance. The impact of this will be significant as the largest number of Polio surveillance staff are in countries with the greatest risk of achieving

elimination. Information from surveillance and outbreak investigation should be systematically used for advocacy at local and national level to increase the commitment of stake holders.

9. Outbreak investigation should receive the highest priority as this would guide the interventions necessary to achieve the elimination goal. The key is to identify the reasons for the outbreak, and chains of transmission (failure to vaccinate versus vaccination failure and who is transmitting disease)
10. The biggest challenge will be strengthening of routine immunization in the country's most lagging. Here, introduction of MV2 is a priority. In addition, the occurrence of measles outbreaks can and should be used an indicator of well (or poorly) performing routine immunization services and as a means to target countries and high risk areas in need of efforts to improve routine immunization coverage.

1.5 Country Case Studies

Zimbabwe

Zimbabwe has an estimated population of 13,061,239 (2014). Of this, 41% is under 15 years of age and the under 5's comprise 15%. The population is predominantly rural, with only 33% living in urban areas. It is divided into 11 provinces and has a total of 63 districts. Between 2002-2008, the country faced economic hardships and had a significant drop in routine immunization coverage. In 2010, it experienced a large outbreak of measles with more than 10,500 cases, an incidence of about 171 per 100,00 population.

Status of measles elimination :

- Zimbabwe has succeeded in keeping the measles incidence very low in the last 5 years (2011-2015), and has also maintained a higher than 90% MCV1 coverage between 2011-2014 with more than 50% of the districts being above 90% in 2014. Wide age-range SIAs were conducted in late 2015. These SIAs used MR vaccine and this has since been introduced into the routine immunization.

Figure 1: MCV1 coverage and reported measles cases, Zimbabwe, 2000 – 2014

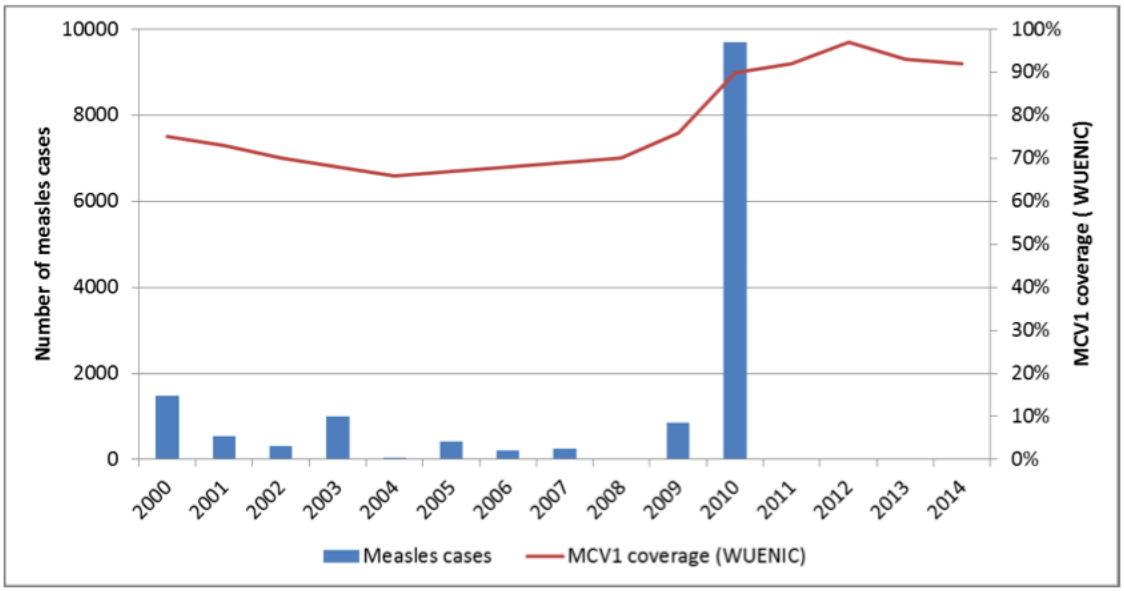


Table 1. MCV1 administrative coverage at district level, Zimbabwe, 2014

MCV1 admin coverage levels in 2014	Number of districts
≥90%	36 (57%)
80 – 89%	22 (35%)
70- 79%	4 (6%)
60 – 69%	1 (2%)
50 – 59%	0 (0%)
<50%	0 (0%)
TOTAL	63 (100%)

- Case based surveillance has been in place since 2001 and has one national measles network laboratory. The country has achieved and maintained the targets for the principal measles surveillance indicators.
- Outbreak preparedness and response was weak prior to the 2010 outbreak, in particular in that the outbreak affected children and older people in apostolic religious groups who were known to resist immunization.
- Reasons for non-vaccination identified during investigations in 2009–2010 included vaccine stock-outs, strict open-vial policies that led to children being batched into infrequent vaccination sessions, and children aged >12 months considered to be ineligible for MCV1. In addition, an unwillingness to be vaccinated was identified among certain religious groups. (This was also seen in Botswana, Malawi and South Africa.
- Lessons learnt from the 2010 outbreak led to development of more aggressive advocacy and social mobilization efforts and currently measures are in place to proactively extend services to communities that have traditionally refused immunizations.

Critical factors for success

- A strong national immunization program since the early 1990s with low missed opportunities for vaccinating children

- Concerted action by partners to support child survival through innovative fundraising and financing mechanisms (Health Trust Fund)
- Significant barriers to achieving progress
- Poor performance of routine immunization during the economic crisis (2002 to 2009) which led to build up of susceptible.
- Vaccine hesitancy among the apostolic religious sect that make up to 33% of the population remains a threat and risk for accumulation of susceptible persons.
- Zimbabwe is currently heavily dependent on donor support for its immunization program.

Burkina Faso

Burkina Faso is a West African country with an estimated (2015) population of 18,450,494, with 8,777,412 (47.6%) being less than 15 years and 3,382,578 (18.33%) less than 5 years of age. The majority of the population (77.3%) is rural based on 2006 census.

Status of measles elimination

- Burkina Faso raised the MCV1 coverage from just under 50% in 2000 to around 90% in 2008 and 2009. Since then, the coverage has stagnated and even dropped to 80% in 2013. The estimate for 2014 was 90%.
- Despite implementation of mortality reduction strategies since 2001, including three nationwide immunization campaigns with >95% estimated coverage during 2001–2007 and increasing routine measles vaccination coverage, Burkina Faso experienced its largest measles outbreak on record in 2009 with over 54,000 cases.. This outbreak was notable for its size and age distribution, with 35% of cases occurring in persons aged ≥15 years. The main risk factor for measles was lack of vaccination, and measles vaccine was effective in reducing risk of measles.

Figure 1. MCV1 Coverage and reported cases of measles, Burkina Faso, 2000 – 2014

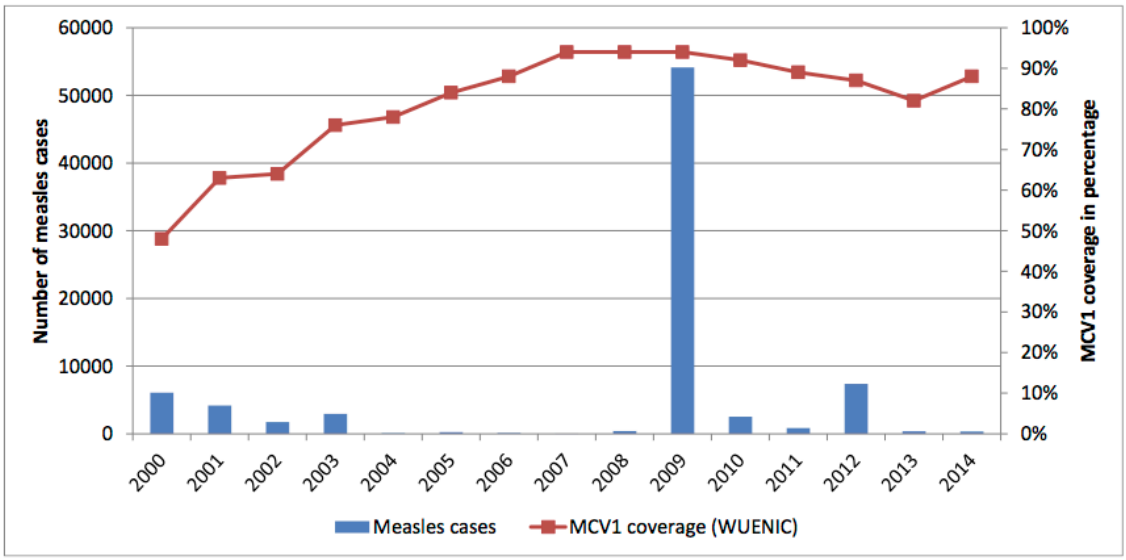


Table 1. MCV1 and MCV2 Coverage and drop-out rates, Burkina Faso 2013 - 2014

Vaccine	Coverage 2013 (%)	Coverage 2014 (%)	Coverage 2015* (%)
MCV1 / MR1 (admin data)	99.8%	99.7%	103.5%
MCV1 / MR1 (WUENIC)	82%	88%	
MCV2 / MR2 (admin data)	-	16.8%	62.6%
Drop-out rate Penta1/MR1	5%	8.3%	4.1%

- Since the 2009 outbreak, the country established an outbreak response plan which includes measles. This guide was used for outbreak investigation and response in 4 districts that had measles outbreaks in 2015.
- The country has introduced MCV2 and rubella vaccine was introduced into the routine immunization program in 2015, following a measles catch-up campaign targeting 8 million children aged 9 months to 14 years of age. All districts achieved more than 90% administrative coverage.
- The country has implemented case based surveillance for measles since 2004, with serology performed at the national reference laboratory. There has been improvement in surveillance performance, e.g. percentage of suspected cases with blood specimens collected increased over three years 2013 to 2015 21% 34% and 86% respectively. In addition, the number of district notifying at least 1 suspected case from which specimen is collected has been 89%, 90% and 76% in the last three years.

Table 2. Measles surveillance performance indicators, Burkina Faso, 2013 -2015

Indicator	Target	2013	2014	2015
Number of measles cases reported through the aggregate system		3752	2352	249
Number of measles cases reported through EPI monthly report		1 589	1492	163*
Number of measles cases reported through the case based surveillance system		772	792	217
% cases with specimen collected	80%	21%	34%	86%
% cases confirmed as measles	< 10%	48%	43%	38%
Non-Measles Febrile rash illness rate per 100,00 population	≥ 2 per 100,000 population	2.29	2.51	0.73
% districts notifying ≥ 1 suspected case with specimen collected	≥ 80%	89% (56/63)	90% (57/63)	76% (48/63)

- The country communications strategies to build confidence in vaccination are in the immunization plan and are updated with introduction of new vaccines
- Innovative strategies are used to access difficult to reach population groups include market day vaccinations, identifying areas with undocumented settlers in the large towns.

Factors for success of program

- Political commitment of the national authorities
- Strong national immunization program
- A functional Inter-Agency Committee
- Committed EPI partners and other stake holders including the national network laboratory

Significant barriers to achieving the goals

- Recent unrest in country due to terrorism threats have compromised security and access for the population
- Shifting of government priorities to combatting terrorism may shift resources from public health programs such as immunizations.

Ethiopia

The total population of Ethiopia is estimated (2015) ate 93,468,911. The country has a federal system of Government with nine Regions and two City Administrations. These are divided into a further 103 zones, 835 Woredas (districts) and more than 20,000 urban and rural kebeles. Approximately 80% reside in rural areas and 80% of the population are in the three biggest regions of Oromia, Amhara and Southern Nations and Nationalities (SNNPR).

Status of measles elimination

The country reports confirmed measles cases every year with numbers peaking between January and May. Outbreaks tend to be geographic in scope, but occur in different parts of the country over the years. This is a reflection of the gaps in population immunity across the country. The second factor is that measles now is increasingly occurring in older children and adults. In 2015, children less than 5 years of age comprised 45% of the total cases. Ethiopia.

In 2014, it was estimated that Ethiopia, along with DR Congo and Nigeria comprise the three countries in Africa with the largest numbers of infants unvaccinated with MCV1 (DR Congo has 0.6 million, Ethiopia has 0.9 million and Nigeria has 3.32 million).

The national MCV1 has never exceeded 70% and administrative coverage data shows differences across Regions. In 2014, only 320 districts (Woredas) had coverage above 90%, 153 (18%) had 80-90%, 205 (25%) had 60-79% and 152 (18%) had an estimated coverage of less than 60%.

Figure 1: Ethiopia MCV1 Coverage, 2000 – 2014

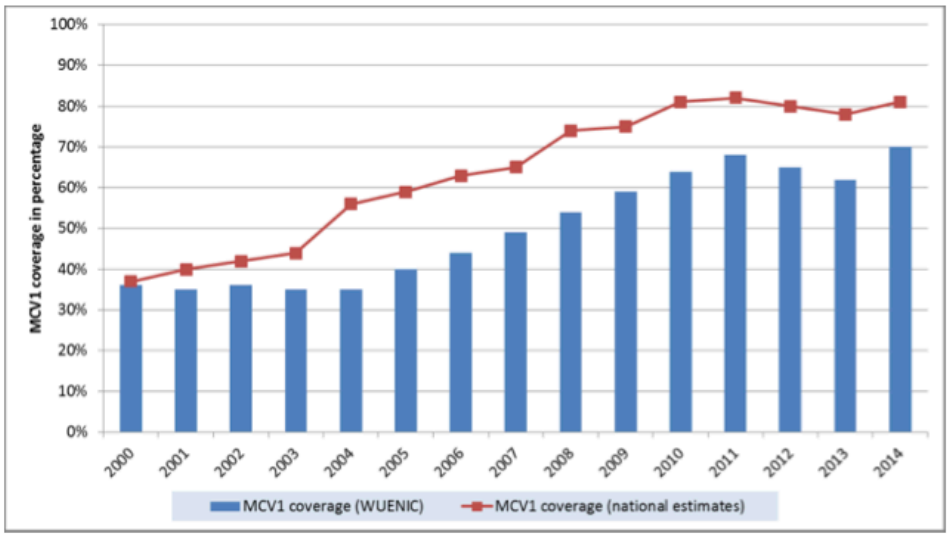
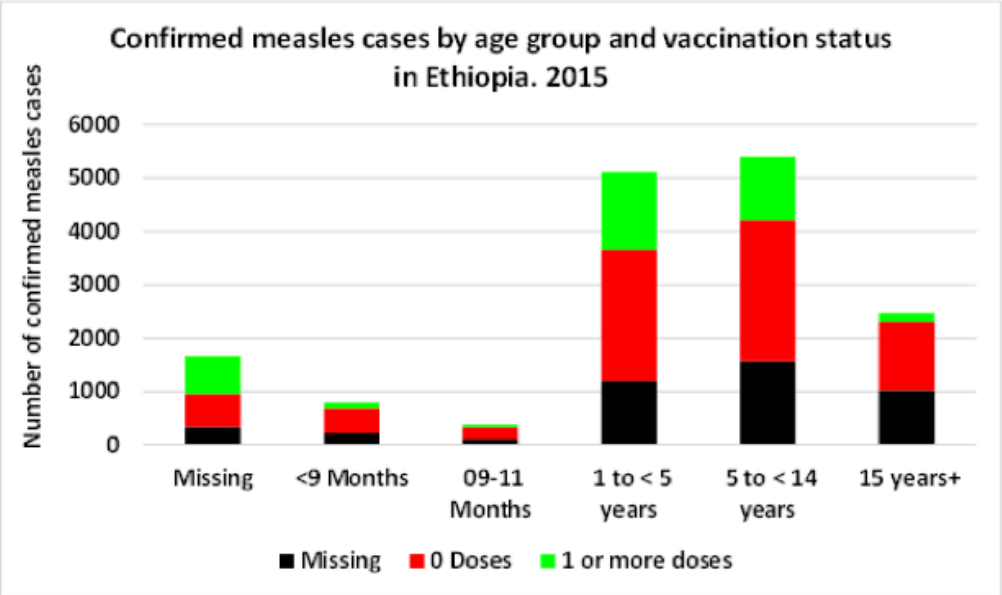


Table 1. Subnational MCV1 Coverage, Ethiopia, 2014.

MCV1 admin coverage levels in 2014	Number of woredas
≥90%	320 (39%)
80 – 89%	153 (18%)
70- 79%	75 (9%)
60 – 69%	130 (16%)
50 – 59%	67 (8%)
<50%	85 (10%)
TOTAL	830 (100%)

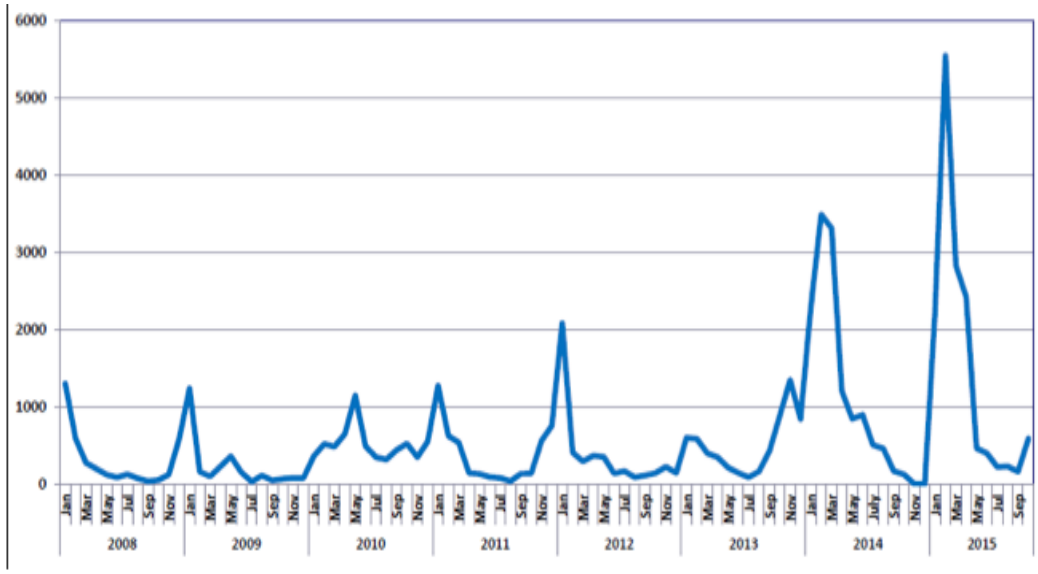
Since the initial measles SIAs conducted in 2004, Ethiopia has not been able to conduct wide-range SIAs despite the epidemiological evidence which shows the shift in age of susceptibility and incidence in older children. This has been primarily due to lack of resources for a wide age group SIA.

Figure 2. Age and vaccination status of measles cases, Ethiopia, 2015



Ethiopia has been experiencing large outbreaks of measles on an annual basis since 2008. These outbreaks have primary been in older children and adults. Outbreak preparedness, investigation and response has generally been inadequate. Multiple program priorities and lack of funds have been given as reasons for this.

Figure 3: Ethiopia: Measles confirmed cases by month, 2008 -2015



Ethiopia has had in place case based measles surveillance since 2005 and has consistently achieved the targets for the principal performance indicators. The laboratory testing of specimens is supported by a national referral laboratory and two subnational laboratories have been established to provide additional support since 2013.

Innovative strategies have tended to focus on trying to reach nomadic population. However, a large number of children remain unvaccinated in regions with large populations where access is not a challenge.

Critical factors for success in achieving the goals

- The best practices in the implementation of measles SIAs in 2010-2011 led to a high level of government commitment to measles elimination
- The government supported program of Health Extension workers, who work at village level has helped to extend health services to rural population. In addition, they are key in improving the quality of SIAs.
- Despite all the current challenges faced by the country, there is evidence of political support for the program. For example, the recently conducted measles campaign covering high risk areas, and targeting over 25 million children aged 6 months to 15 years, covering zones hardest hit by the drought, received substantial government financial support, in addition to that received from partners.
- Ethiopia is one of the countries in the African Region that has benefited from the presence of a sizeable number of Polio staff within the WHO EPI team. These staffs have been key in implementing measles elimination strategies and the country has very good measles surveillance performance as a result of the polio-paid infrastructure and experience.

Critical barriers to achieving goals

- Competing priorities within countries to address other major life threatening concerns such as drought and inadequate advocacy for prgramme visibility except during times of outbreaks
- Ethiopia suffers frequently from severe drought and famine which leaves many children severely malnourished and highly vulnerable to diseases. The death rates among children in such situations of complex emergencies have been reported to be more than twice as high as in normal populations. For example, during a famine in Ethiopia, measles alone or in combination with wasting accounted for 22% of 159 deaths among children younger than five years of age, and 17% of 72 deaths among children aged five to fourteen years.
- Inadequate political leaderships, inadequate allocation of resources, poor logistics systems, health manpower, non-use of data for action, population pressures, insecurity, limited geographic access to some parts of the country, other program priorities and emergencies, such as frequent drought which affects the country.
- Major population immunity gaps that exist across most or almost all the regions and in particular in regions with large populations
- Verification of immunization coverage data at subnational level in some regions as this may provide false sense of security
- Failure to sustain the gains achieved as a result of the polio eradication initiative in establishing surveillance and implementation of high quality SIAs.
- Dependency of the program on external and donor funding for both routine immunizations and activities for the MRI.

In summary, Ethiopia is an example of a country with a high burden of disease, the plateauing in the routine immunization coverage at regional level, the gaps in SIAs quality, the shift in epidemiological susceptibility to older age groups. Special efforts to increase vaccination coverage in emergency situations must continue to be given highest priority.

2 AMRO Region

2.1 Objectives:

1. To provide a candid review of progress towards, and key political, financial and technical reasons for the sustainability of Measles and Rubella Elimination in the Americas, according to 2015 World Health Assembly targets and regional elimination goals;

2. To assess the quality of implementation of the Global Measles and Rubella Strategic Plan, 2012-2020's five key strategies and four guiding principles and provide recommendations on how the strategies and principles should be refined to address weaknesses in immunization systems and to accelerate progress towards the global and regional goals;

2.2 Regional control and/or elimination targets

1. **Measles targets**: The Americas achieved measles elimination in 2002, when the last endemic case was reported on 16 November 2002 in Carabobo, Venezuela.
   Between 2013 and 2015, the northern state of Ceará in Brazil reported an outbreak of more than 24 months of transmission; rash onset of the last case was July 6, 2015.

2. **Rubella targets**: The Americas achieved rubella and congenital rubella syndrome elimination in 2009; the last endemic rubella case was reported on February 3, 2009 in Buenos Aires, Argentina and the last endemic CRS case was reported on August 26, 2009 in Brazil.

2.3 Summary of progress towards regional targets:

1. Summary table (**Table 1**)

One of the strengths of the Americas Region and an essential factor in achieving the elimination of measles and rubella was the early introduction of the measles-mumps-rubella vaccine (MMR) into national routine programs, with the exception of Haiti, which is using measles-rubella containing vaccine (MR).

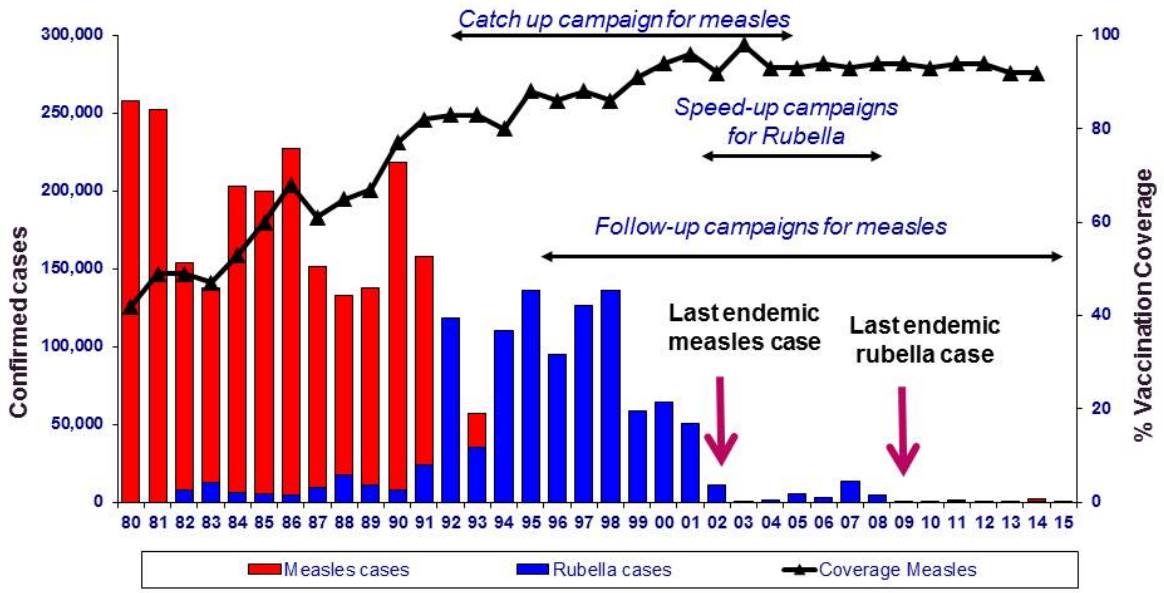
In 2014, 23 out of 33 countries[1] (70%) in the Americas reached a national coverage of ≥90% with the first dose of measles-mumps-rubella containing vaccine (MMR1), based on WHO and United Nations Children's Fund (UNICEF) data. Of these 23 countries, 18 (55%) reported that 80% or more of their municipalities achieved ≥90% of coverage with MMR1.

[1] In 2004, 33 of 35 countries of the Americas Region reported MMR1 coverage to the WHO/UNICEF Joint Reporting Form. Data were not provided by Canada and the United States.

The second dose of MMR (MMR2) was introduced into the routine immunization schedules in 30 of 35 countries (85%). Among the 27 countries that reported MMR2 coverage in 2014 through the WHO/UNICEF Joint Reporting Form, 55% (n=15) achieved a coverage of ≥90%; 12 countries (44%) reported that 80% or more of their municipalities achieved ≥90 of coverage.

The implementation of PAHO's recommended elimination strategies was very successful in achieving measles and rubella elimination goals, including the strengthening of the National Immunization Programs and Epidemiological Surveillance Systems. The so called "Catch-up", "Follow-up" and "Speed-Up" mass vaccination campaigns, in tandem with high and homogeneous vaccination coverage achieved at the national and local levels through the routine immunization program, dramatically reduced the occurrence of measles and rubella cases *(Figure 1).*

Figure 1. Impact of measles and rubella elimination strategies: The Americas*



Source: Country reports to FGL/IM - PAHO
* Data as of February 26, 2016

For the period 2014-2015, 97% of countries in the Americas maintained a measles incidence rate at <5 cases per million. Canada was the only country that reported an incidence rate of 11.8 cases per million (corresponding to 418 cases) in 2014 and 5.5 cases per million (corresponding to 196 cases) in 2015.

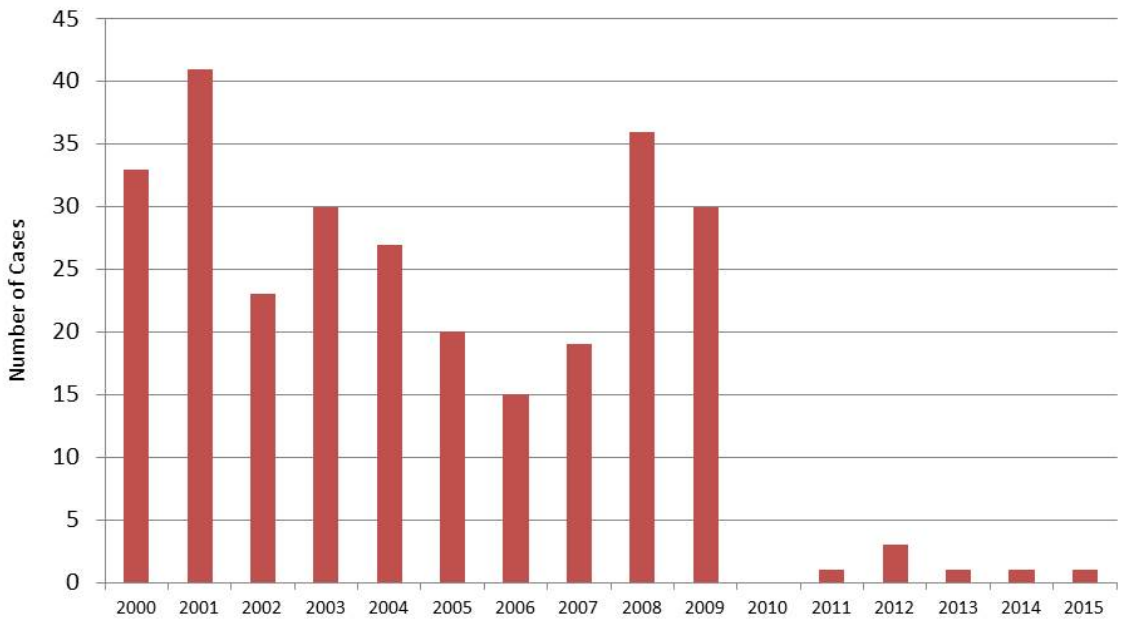
Despite sustained measles transmission in Brazil for more than two years, the incidence rate there was <5 cases per million. In 2014, Brazil confirmed 876 measles cases, with a measles incidence rate of 4.3 per million population; while 214 cases were confirmed in 2015, for a rate of 1.1 per million population.

The regional measles mortality rate was reduced to 0 in 2000, and only 11 deaths have been sporadically reported in the context of outbreaks: Brazil-2 deaths in 2004 and 1 death in 2014; Ecuador-3 deaths between 2011 and 2012; the United States-1 death in 2015; and Venezuela-3 deaths in 2002 and 1 death in 2007.

Rubella was eliminated in 2009, and in April of 2015, the International Experts Committee (IEC) for regional measles and rubella verification declared the Americas free of rubella and congenital rubella syndrome (CRS). Compared to 2000, there has been a reduction of 99% in cases of CRS in 2015. According to estimates using the Cutts[1] model, the Americas have prevented 16,000 cases of CRS per year. Between 2010 and 2015, there have been seven importation-related CRS cases in two countries (*Figure 2*).

With regard to financial investment, all countries in Latin American and the Caribbean (LAC) pay for more than 50% of operational costs of their mass vaccination campaigns, with the exception of Haiti, which needs full financial support (100%). Likewise, all LAC countries were trained in detecting and reporting Adverse Events Following Immunization (AEFIs) before implementing their mass vaccination campaigns, following PAHO/WHO's recommendation. The training takes place during the campaign planning and is a required component included in campaign technical guidelines. Finally, all LAC countries implemented periodic evaluations of their epidemiological surveillance systems. These evaluations may take place in tandem with the National Immunization Programs.

Figure 2. Congenital Rubella Syndrome (CRS) cases Region of the Americas, 2000-2015*



Source: ISIS, MESSS and country reports to FGL-IM/PAHO.
*Data as of February 26, 2016.

2.4 Summary of implementation of each of the five key strategies

1. Achieve and maintain high levels of population immunity with two doses of measles and rubella containing vaccines;

Reported regional **MMR1 coverage** for 2014 was 91%, compared with 92% in 2013 and 94% in 2012, reflecting a steady decrease over the last three years. In 2014, 16 out of 35 countries reported national MMR1 coverage greater than 95%; 15 countries reported coverage between 80% and 94%; and four reported coverage between 50 and 79%.

When examining coverage at the subnational level, 55% of all municipalities in the Region reported coverage of at least 95% for MMR1 in 2014, without a significant decrease in comparison to what was reported in 2013 (54%). Around 4.5 million children (46%) live in municipalities with MMR1 coverage ≤95%. In addition, 42% municipalities in 2014 reported coverage ≥100%.

Reported regional **MMR2 coverage** for 2014 was 86%, compared with 71% in 2013 and 77% in 2012. Large countries such as Brazil, Mexico and Colombia reported an increase in MMR2 coverage greater than 20% in comparison with the previous year, and therefore, further analysis will be implemented to assess the accuracy of these reports. In 2014, four out of 35 countries reported national MMR2 coverage greater than or equal to 95%; 17 countries reported coverage between 80% and 94%; and five reported coverage between 50 and 79%. Five countries[2] have not introduced MMR2 into their regular schedule, but do give a second dose of MMR through periodic follow-up campaigns (every four or five years).

In 2013, to achieve the highest possible MMR2 coverage, the PAHO/WHO Technical Advisory Group (TAG) on Vaccine-preventable Diseases recommended administering MMR2 to 15-18 month olds at the same time as other vaccines in the regular program, such as the first booster of the diphtheria, tetanus, and whooping cough (DTP) vaccine. To this end, 10 countries administered the MMR2 dose to infants aged 15-18 months in 2014.

Approximately 16 million children aged 1-5 years old and living in six countries received MR vaccine, during follow-up campaigns (also known as SIAs) conducted between 2014 and 2015. Five countries administered oral polio vaccine and deworming medication during their SIAs. Failure to achieve coverage ≥95% was observed in four countries, which reported administrative coverage between 72% and 89% (Table 2). Poor campaign coverage underscored issues in the timely planning of this activity at the sub-national and local levels, as well as the lack of regular monitoring to ensure high-quality implementation at the local level. Rapid Coverage of Monitoring (RCM) has been implemented at the end of each campaign to identify pockets of unvaccinated children that could be masked by the average coverage figures reported by the municipalities.

The combination of the decreasing trend in reported regional MMR1 coverage and decreases in the percentage of municipalities reporting coverage ≥95% and poor campaign coverage is of great concern. Given that measles and rubella viruses continue to circulate in other regions of the world, stagnant or decreasing coverage in the Americas places the immunization achievements of the entire Region at risk and requires collective action in order to counter these trends.

[2] Bolivia, Guatemala, Haiti, Honduras, and the Dominican Republic

Table 2: Measles supplementary immunization activities (SIAs) by country, 2014-2015*

Country	Year	Age group targeted	Children reached in targeted age group		Target number	Vaccine used
			No	%		
Argentina	2014	1-4yr	2,347,019	82	2,865,714	MR + OPV
Brazil	2014	1-4yr	9,805,805	89	10,990,802	MMR + OPV
Paraguay	2014	1-5yr	535,703	72	738,619	MMR +OPV
Venezuela	2014	1-5yr	2,466,543	99	2,479,348	MMR + OPV
Chile	2015	1-5yr	1,005,221	81	1,240,584.00	MMR
Dominican Republic	2015	1-4yr	742,792	95	778,878	MR + OPV

*Administrative data as of February 23, 2016. Source: WHO/UNICEF Joint Reporting Form sent to PAHO

2. Monitor disease using effective surveillance

Table of surveillance indicators (see **Table 3**)

All countries in the region have a sensitive and timely case based measles and rubella/CRS *surveillance system*. In the period 2012-2015, the Americas region, on average, met the targets for two of the five epidemiological surveillance indicators[3] (>80%) but not on a continuous basis. A decrease in performance with regard to all indicators was observed in 2015 in comparison with 2014. Additionally, logistics difficulties and delays in entering the data into the surveillance systems were identified as major barriers to achieving the laboratory indicators.

The quality of the active epidemiological surveillance is not always homogenous at the sub-national and local levels. Therefore, where gaps in the surveillance exist, countries use alternative and complementary lines of evidence, such as conducting active case finding, to document the absence of measles and rubella cases. To this end, seven countries[4] implemented active institutional and community case-finding for measles and rubella at the end of the 2014's FIFA World Cup in their territories (period of July-December 2014). These countries established criteria to identify the areas where active searches would be implemented, such as municipalities not reporting suspected cases; areas with a high influx of tourists, migrants or displaced people; border areas; areas with low vaccination coverage; and areas with large numbers of ethnic groups. Approximately 2.8 million medical records were reviewed in 692 health services and 60,100 community searches were implemented by two countries, including 380 tourist locations. No cases of confirmed measles or rubella were found.

[3] The indicators are: % sites reporting weekly; % of cases with adequate investigation (indicator made up of % of cases with household visit within 48 hours following reporting, and % of cases with the following eight data points); % of cases with adequate blood specimen; % of blood specimens received in laboratory in ≤5 days; and % of laboratory results reported in <4 days.

[4] Argentina, Chile, Haiti, Honduras, Nicaragua, Mexico and Peru

In the post-elimination phase, additional strategies (i.e. increased collaboration between multidisciplinary groups for final case classification; adequate outbreak investigation and an emphasis on rapid response; improved coordination with the private sector; and improved coordination with dengue surveillance in the countries) were added to ensure high-quality surveillance.

3. Develop and maintain outbreak preparedness, respond rapidly to outbreaks, and manage cases

Outbreak preparedness for rapid response

Having achieved measles elimination in 2002 and rubella elimination in 2009, the basic strategy for rapid outbreak response among PAHO countries is to *"get ahead of the virus"*. Getting ahead means monitoring the accumulation of susceptible persons, early detection of cases, detailed epidemiological investigation (i.e., chains of transmission), follow-up of contacts of confirmed and suspected cases, vaccination of contacts lacking documentation of having received two doses, and active case searches.

To this end, PAHO has provided tailored technical assistance to its Member States and developed different tools to quickly control outbreaks; below is a brief summary of the main points:

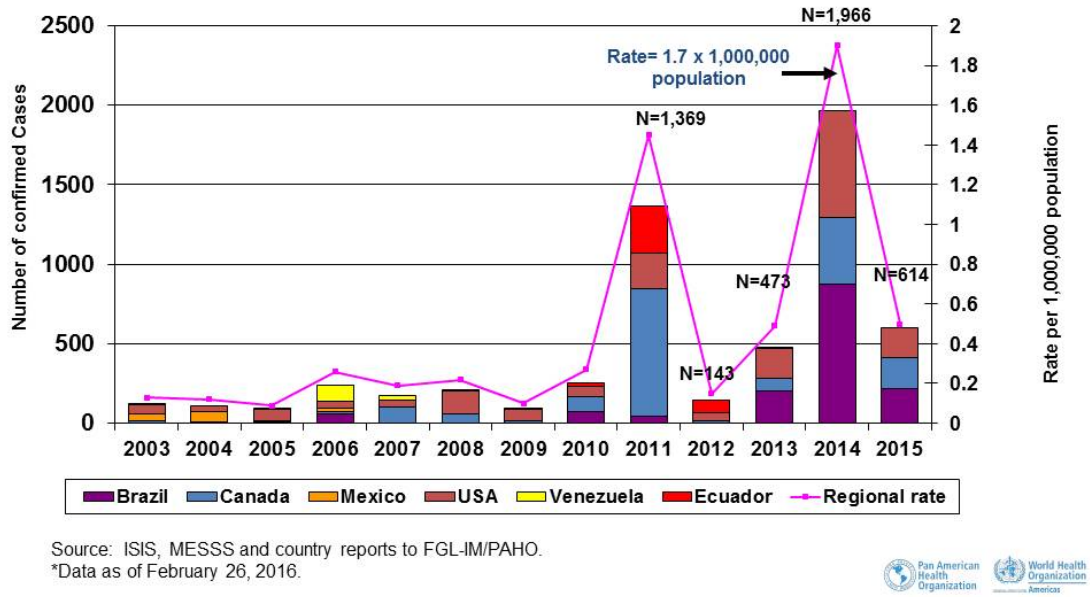
- In response to the need for guidance to detect possible outbreaks due to virus importations and contain them in the post-elimination era, PAHO trained national surveillance officers from **29 countries of the Americas** at the end of 2013, following a new outbreak response method that compiled essential lessons learned to get ahead of the virus. During 2014-15, at least four countries replicated this method, targeting their national and sub-national field epidemiologists and laboratory technicians.
- Considering the substantial number of international travellers to the Americas each year and the several mass gathering events held in countries in the Region (i.e. 2014's FIFA World Cup, 2016's Olympic Games, etc.), PAHO issued special global epidemiological alerts to advise persons attending international sporting events to be vaccinated against measles and rubella at least two weeks before traveling. In addition, PAHO produced communication materials, including a short video, which was widely disseminated through social media and in airports.
- Contact tracing is one of the main actions to quickly control an outbreak. Owing to international travel, contact tracing may require inter-country and even interregional collaboration. To this end, the International Health Regulation (IHR) and its National Focal Points were pivotal in encouraging the timely notification of measles cases (considered a public health event of international concern), while facilitating the necessary coordination for contact tracing among foreign individuals.
- Experienced field consultants with technical expertise and leadership skills obtained from supporting health authorities in outbreak control responses, including mass vaccination activities, were deployed. This team travelled from country to country in the region, assisting local PAHO staff and surveillance and immunization officers with logistics and organization of the outbreak response and the field investigation. This cadre of consultants also collaborated in strengthening the rapid response teams at all levels.

- Due to the complex characteristics of measles outbreaks in the post-elimination era, PAHO developed a set of criteria for confirming when circulation of wild measles or rubella virus was successfully interrupted (Annex 1). Because a single case of measles is considered an outbreak in the Region of the Americas, these criteria apply to any outbreak, even if there is only a single confirmed measles case. These criteria complement the routine surveillance of measles and rubella and are not intended as substitutes for the national indicators of when an outbreak has occurred.
- Finally, PAHO aims to finalize guidelines for measles and rubella outbreak response in the post elimination era. An advanced draft (Spanish version) incorporating essential lessons learned from the recent measles outbreak in Ceará, Brazil is under review.

Characteristics of measles outbreaks in 2015

Following the impressive achievement in interrupting endemic measles transmission in 2002, the Region of the Americas has faced major challenges, with repeated importations of measles in some countries. The total number of measles cases attributable to importations of the virus across the Americas from 2003 to 2014 reached 5,277 cases, most of which occurred in 2011 (n=1,369) and 2014 (n=1,996). In 2015, a total of 614 cases had been reported as of epidemiological week (EW) 53 (ending on 3 January 2016), most of which were related to the ongoing measles outbreak in Brazil, a large multi-state outbreak in the United States, and multiple outbreaks in Canada (*figure 3*).

Figure 3. Distribution of confirmed measles cases. The Americas, 2003-2015*



Source: ISIS, MESSS and country reports to FGL-IM/PAHO.
*Data as of February 26, 2016.

The first outbreak of measles in the post elimination era occurred in the northern state of **Ceará**, **Brazil**, where a total of 1,052 measles cases were confirmed between 25 December 2013 and July 6th2015 in 38 of 184 municipalities. The genotype identified was D8. Adolescents and adults aged 15-39 years old were the most affected group in this outbreak (39%), followed by children aged 6-11

months (28%). Around 73% (n=768) of the confirmed cases were unvaccinated and 9% (n=95) had unknown vaccination status; 44% of the unvaccinated (n=288) individuals were aged 15-39 years old. Among vaccinated individuals, 93.1% had received one dose of MMR vaccine and 7% had received two doses. These data demonstrate, again, that one dose of measles vaccine is insufficient to maintain measles elimination.

Slow but continuous transmission ("drop by drop transmission") showcased the failure to implement an aggressive and quick outbreak response, as well as the presence of dispersed unvaccinated individuals within populations with high reported measles vaccine coverage. Today, endemic measles virus had been re-established in Brazil, as the outbreak had persisted in the country for over 24 months. Brazilian national authorities presented a preliminary report to the IEC for regional measles and rubella verification on December 2015, with evidence that the outbreak had finally been interrupted.

In the **United States**, 111 cases (63%) were associated with an outbreak that originated in late December 2014 in **Disney** theme parks in Orange County, California. The source of the initial exposure has not been identified, but measles cases associated with this outbreak were reported in seven U.S. states, Mexico, and Canada. The B3 genotype was identified as causing this outbreak. By December 31, 2015, a total of 189 measles confirmed cases were reported by 24 states and the District of Columbia. The most affected group was adults aged 20-39 years old (38%), followed by infants less than 1 year old (14%) and adolescents and young adults aged 10-19 years old (13%). Among the 155 confirmed cases with data available on sex, 54% were in males and 46% in females. A total of 33 (18%) cases were reported as hospitalized, including eight cases with pneumonia. One death was reported. The majority of the 189 patients with reported measles were either unvaccinated (52% [n=98]) or had unknown vaccination status (32% [n=60]); 30 cases (16%) has received measles vaccine. Different genotypes were identified (i.e. B3, H1, D8, D9, D4), but many importations were reported as having an unknown source of infection.

Canada has reported 196 confirmed measles cases in four provinces, of which 29% (n=57) were laboratory confirmed and 71% (n=139) were epidemiologically linked to a laboratory confirmed case. Cases of measles were most commonly reported among adolescents and young adults aged 10-19 years old (47%), followed equally by adults aged 20-39 years old (19%) and children 5-9 years old (19%). The majority of the measles cases reported were unvaccinated (86% [n=169]; only 17 cases had received measles vaccine (8.6%). A total of 56 measles cases were genotyped and the genotypes included B3 (n=23), D4 (n=17), H1 (n=11) and D8 (n=5).

Chile reported an outbreak of nine cases in Santiago, the capital of the country, between May and August 2015. The genotype identified was H1. The index case in this outbreak had a travel history to China, where this genotype is currently circulating. Six of the seven cases were among men; the age distribution was: <1 year (n=2); 20-39yrs (n=4) and >40 years (n=1).

Between May and June 2015, **Peru** reported an outbreak of four cases among young adult German citizens (aged 21 years old), who were working as volunteers in a clinical facility. Aggressive outbreak control measures were implemented to limit further secondary spread. The genotype identified was D8. Finally, isolated cases of measles were reported by Mexico and Colombia, respectively. On January 23rd 2015, **Mexico** reported an isolated case in a 37 year old woman, with a travel history to the United States during her infectious period. No genotype was identified.

Colombia reported an isolated imported case in a 23 year-old Swiss woman on September 2015. Genotype B3 was identified and no secondary cases were found after aggressive control measures were employed.

4. Communicate and engage to build public confidence and demand;

Overall, Latin American and the Caribbean countries (LAC) have a strong pro-vaccination culture, and the population demands immunization services, which they recognize as a public good. However, the maintenance of high and homogeneous levels of MMR1 vaccination coverage is at risk, as under-vaccination and missed opportunities have been reported more frequently. Recent studies in six countries in Central America[i] related the occurrence of missed opportunities to vaccinate primarily with health care workers failing to immunize the child during his/her visit.

The literature review of the WHO's Strategic Advisory Group of Experts (SAGE) on vaccine hesitancy identified many studies of vaccine hesitancy from the Americas, but limited data were published from LAC. There have, however, been informal reports of growing anti-vaccine sentiment in countries such as Chile, Peru and others in the region. Increasing connectivity to the Internet across LAC facilitates the easy spread of misinformation and rumours.

In the United States and Canada, vaccine hesitancy is a growing concern; this hesitancy has been linked to a lack of confidence in recommended vaccines and delays in vaccination. In both countries, the presence of communities who refuse vaccination (i.e., religious groups) has been at the centre of several measles outbreaks. Aggressive outbreak control measures have prevented further spread of the measles virus into the wider population. PAHO is coordinating the development of a research agenda on vaccine hesitancy with the United States and Canada, to better understand what strategies may be more effective in boosting vaccine confidence and what specific messages work with what sub populations.

5. Research and development to support cost-effective operations and improve vaccination and diagnostic tools.

The United States has assessed the containment costs for 16 measles outbreaks that occurred in different time periods. Overall, the total economic burden associated with measles outbreaks ranged from an estimated $2.7 million to 5.3 million. The average cost per outbreak ranged from $2,685 to 22,000 for small outbreaks; $58,000 to 146,000 for medium, and from $551,000 to 985,000 for large outbreaks[ii]. Further economic evaluations will be implemented in other PAHO countries in 2017.

In addition, PAHO is finalizing a manual for implementing Rapid Coverage Monitoring (RCM) at the end of follow-up campaigns against measles and rubella (also known as SIAs). RCM is specifically focused on identifying unvaccinated children and/or areas during the campaign and vaccinating them. RCM is not a tool to assess coverage, and therefore, does not produce valid coverage estimates.

2.5 Successes and failures in applying the four basic principles

1. Country ownership & sustainability

Over the past 20 years, the ownership of the National Immunization Programs by the Ministries of Health has been instrumental in achieving and maintaining measles and rubella elimination. Simultaneously, the Pan-Americanism embraced by PAHO's Member States allowed working towards a common goal, following common standards, strategies and technical criteria established by PAHO.

The allocation of national financial resources by 97% of the countries in the Region (except Haiti) to ensure the sustainability of measles and rubella elimination, is one of the strongest forms of evidence of the on-going political commitment.

Following the 2007 PAHO Resolution[5], an independent International Expert Committee (IEC) and 23 national commissions were established, including one for the French Overseas Departments of the Americas and one subregional commission for English-speaking and Dutch-speaking Caribbean countries and territories, including Suriname.

Each national commission reviewed and approved the reports on elimination, which were submitted to the IEC through PAHO/WHO. These reports included a plan of action to sustain the elimination of both diseases in their territories, with the allocation of financial resources that reflects the political will and the availability of human resources and infrastructure.

Currently, PAHO has requested that its Member States update their elimination reports for the period 2012-2015, with an emphasis on sustainability efforts. With the submitted evidence, the IEC, in tandem with the National Verification Commissions and officers from the Ministers of Health, will discuss the feasibility of declaring the Americas free of measles in September 2016.

2. Routine immunization and health system strengthening

There are many areas involved in linking the measles and rubella elimination initiative with routine immunization and health system strengthening, including the following:

- The delivery of vaccination services in a sustainable, equitable (achieving universal vaccine uptake), effective and high quality manner, within the framework of integrated health services (i.e., together with deworming medication).
- The visibility of the National Immunization Program (NIP) and Surveillance Directorate, by achieving long-term and high-political support at all levels (national, sub-national and local levels).
- The development of managerial capacities at all levels, including continuous training of human resources, especially in planning, budgeting, monitoring and supervision, which have contributed to the control of other EPI diseases. In addition, staff were

[5] Resolution CE 140.R10 issued on June 2007 during the 28th Pan American Sanitary Conference

trained in the use of different inter-cultural approaches, to increase community demand for immunization and other health services.

- The development of partnerships with key donors and stakeholders, to consolidate mechanisms that will improve the mobilization and allocation of resources for the NIP (i.e. Inter-Agency Coordination Committee).
- The strengthening of the epidemiological and laboratory systems, by improving the capacity of human resources to quickly detect and respond to other public health emergencies (i.e. influenza, Ebola, etc.) and consolidate a regional laboratory network that can be used for other diseases.
- The preparedness and strengthening of health systems to address any public health emergency, based on the foundation of the successful elimination of measles and rubella.

3. Equity

The measles/rubella (MR) initiative has taken the lead in showing that equity is possible. Given that MR aims to reach 100% of the population, it has contributed to the reduction of inequities based on sex, race or ethnicity, social status and geographical location. Under the slogan of "reaching the unreached", the mass vaccination campaigns to eliminate rubella and CRS targeted a population that had never been vaccinated, and provided the foundation for the delivery of basic health services in many undeserved areas.

Brazilian health care worker vaccinating a child from an indigenous community

4. Linkages (e.g. polio eradication)

The Measles and Rubella elimination initiative has taken the lessons learned from the Polio Eradication Initiative, such as working with a well-trained work force; using the infrastructure built over 20 years in terms of cold chain, logistic and supplies; and using social communication and mobilization strategies, among others. The elimination initiative has also generated many lessons learned that have been applied to the introduction of new

vaccines. Overall, the legacy of the elimination initiative suggests that it provided excellent opportunities to strengthen the national immunization program and the surveillance systems. It also focused international attention by establishing a regional goal and commitment, to solve a common public health problem.

2. Conclusions and Lessons Learned
   Below is a list of factors that contributed to the success in eliminating measles and rubella (pre-elimination era) in the Region of the Americas and the critical factors that have sustained the elimination gains there (post-elimination era), including the challenges for the near future. Of note, there may be similarities between these two phases regarding the use of vaccination/surveillance strategies, as well as technical cooperation and collaboration with national authorities.

PRE ELIMINATION ERA (Measles: 1994-2002; Rubella: 2003-2009)

1. Country ownership and high political commitment at all levels, including the President, as evidenced by resources allocated by governments and local institutions.
2. PAHO's resolutions for Measles Elimination (1994, 1995 and 1996) and Rubella Elimination (2003), which were endorsed by all Ministries of Health.
3. Pan Americanism as a form of regional cohesion, to push forward the implementation of the elimination agenda.
4. Intense and on-going advocacy efforts to ensure partners' endorsement and resource mobilization (i.e. Interagency Coordination Committee).
5. Recommendations issued by PAHO's Technical Advisory Group on Vaccine Preventable Diseases, to support the operational feasibility of the elimination strategies.
6. Full adoption and implementation of PAHO's three-pronged elimination strategies by its Member States:

Vaccination	Surveillance
• Catch-up campaign; children age 1 to 14 years • Keep up to maintain coverage >95% in the routine program • Follow-up campaign; preschool aged children • Introduction of MMR or MR in routine program • Speed-up campaign against measles and rubella in adolescents and adults.	1. Integrated measles/rubella surveillance • Reporting, investigation, response and case classification of suspected and confirmed cases • Development of surveillance performance indicators and electronic tools: MESS and Integrated Surveillance Information System (ISIS) 2. CRS surveillance • Reporting, investigation, response and case classification of suspected and confirmed cases. 3. Laboratories activities for measles/rubella and CRS • Development of a Regional Laboratory Network in 1995. • Serological diagnosis • Viral isolation and identification of measles and rubella virus.

7. Dissemination of standardized technical guidelines and tools (i.e. case definitions), which allowed the successful implementation of PAHO's recommended elimination strategies.
8. Implementation of rapid coverage monitoring (RCM) at the end of mass vaccination campaigns (follow-up and speed up) and active case finding as part of the outbreak control measures.
9. Tracking and monitoring progress in the implementation of the elimination strategies: country presentations at PAHO sub-regional meetings and TAG; progress reports submitted to PAHO's Governing Bodies; and compilation and dissemination of lessons learned and best practices.
10. Active participation of the National Immunization Technical Advisory Groups (NITAG), as well as scientific societies, public health experts, and community and opinion leaders, among others.
11. Promotion of the measles/rubella elimination initiative and vaccination demand, during Vaccination Week of the Americas (VWA).

POST- ELIMINATION ERA

The above mentioned factors, which were essential to the elimination of measles and rubella, were maintained in order to sustain the elimination gains (i.e., country ownership, high political commitment, and Pan-Americanism, among others). Several consultation mechanisms, such as TAG meetings, NITAGs and ICCs, have also played a key role in the deliberation about and adoption of PAHO's recommendations to sustain the elimination of both diseases.

Nevertheless, countries of the Americas are confronting challenges to sustaining the elimination of both diseases. Low levels of measles virus transmission (drop-by-drop) in areas that reported high vaccination coverage were observed in the recent outbreak in Brazil. The occurrence of these new challenges demands that PAHO remain flexible and adjust its technical support to individual country realities and epidemiological scenarios. Below are the main factors that have contributed to the sustainability of measles and rubella elimination in the Americas:

1. Presence of measles/ rubella plans of action to sustain the elimination; and/or activities incorporated into the annual NIP plans of action, with allotted national resources.
2. Presence of National Verification Commissions as independent bodies to oversee the documentation and verification of measles/rubella elimination, as well as the analysis of cases that present challenges in their final classification.
3. Implementation of periodic follow-up campaigns targeting pre-school children to reduce the accumulation of susceptible individuals.
4. Intensification of vaccination activities targeting groups at high risk (i.e. travellers or health care workers) or adolescents and young adults affected by a measles outbreak.
5. Implementation of rapid coverage monitoring (RCM) in the routine program and post campaigns, to identify and vaccinate susceptible individuals who may be at risk of measles/rubella virus following virus importations.
6. Periodic active case finding for measles and rubella when surveillance indicators are below the expected rate and/or after outbreaks.
7. Periodic training of health care workers in implementing a rapid response to measles/rubella outbreaks, to fulfil PAHO's strategy of getting ahead of the virus.
8. Implementation of new laboratory assays to improve measles/rubella diagnosis and genotyping information (i.e. IgG seroconversion, Avidity, RT-PCR and sequencing).
9. After the H1N1 pandemic influenza, the national laboratories adopted molecular assays for RNA detection and genotyping.
10. Dissemination of epidemiological alerts in the face of mass gathering events.
11. Implementation of Data Quality Assessment (DQA) in at least seven countries and National Vaccination Surveys (i.e. Bolivia, El Salvador or St Lucia), to have a better estimate or MMR1 and MMR2 coverage.

BARRIERS OR CHALLENGES

1. Compelling public health emergencies such as Zika and Chickungunya virus, which have become the highest political priority among countries of the Americas.
2. Human and financial resources are often re-directed to deal with other public health priorities, with potential impact on the quality of routine immunization and surveillance activities that are key to sustaining the elimination gains.
3. Global efforts are threatened by the lack of financial resources, which is also a major threat to the sustainability of elimination in the Americas.
4. Poor campaign planning and lack of the supervision needed to ensure high-quality campaigns at the local level have a direct linkage to not achieving vaccination coverage ≥95% at the national/subnational level; and ≥95% in at least 80% of municipalities.
5. Reported high vaccination coverage areas (≥100%) mask immunity gaps at the local level, and have led to a false sense of security among program managers. The latter have potential implications in implementing an aggressive outbreak response to end virus transmission quickly.
6. Current surveillance indicators need to be changed/adjusted, to reflect the new epidemiological scenarios and challenges.
7. High turnover of staff and health workers and new cohorts of physicians who have never seen a measles/rubella case is becoming a silent risk factor for the sustainability of elimination.
8. CRS surveillance has to be strengthened, mainly at the specialist health services, to identify rubella virus circulation, as 50% of rubella infections are clinically silent.
9. Procurement of laboratory supplies and reagents may be delayed, due to the lack of financial resources.
10. Bureaucracy and tedious regulations requested by the National Authority and Customs Agents are delaying the release of laboratory supplies and reagents.

1. Summary of what additional activities, strategies/tactics, and resources are needed to achieve the regional targets (2016-2020)

The **10 key actions** to sustain the elimination gains in the Americas are the following:

1. Engage continuously country ownership and political commitment at all levels (preferably at President's level), given the other multiple and compelling public health priorities (i.e. Zika virus). Commitments should be reflected in the availability of sufficient human and financial resources that guarantee a high-level of implementation of the required actions.
2. Maintain the Pan Americanism within PAHO's Member States, as a common motto to push forward and fully implement the sustainability agenda. To this end, PAHO will submit the Regional Framework for the Sustainability of Measles/Rubella/CRS elimination for the endorsement of the Member States in 2017.

3. Sustain the commitment and collaborative efforts of partners and stakeholders (i.e. scientific societies), to keep the Region free of measles and rubella.
4. Implement tailored vaccination strategies to reach unvaccinated children and high-risk groups and/or areas (i.e. rapid coverage monitoring), to increase MMR1 and MMR2 vaccination coverage in each municipality. Additionally, use community engagement in tandem with an intercultural approach, to sustain demand for immunization services.
5. Implement periodic high-quality follow-up campaigns, to reduce the accumulation of susceptible individuals.
6. Increase the quality of the measles-rubella surveillance indicators and the early detection of imported-cases, through on-going supervision at the national and subnational level; training of human resources (epidemiologists, clinicians, lab technicians, etc.); and periodic implementation of active-case finding.
7. Increase data analysis at the local level, to foster data ownership by all parties (Epidemiology, Immunization and Laboratory), while motivating active participation in any needed corrective measures.
8. Implement aggressive outbreak response following the main PAHO strategy of getting ahead of the virus.
9. Guarantee sufficient laboratory supplies and reagents for serologic and molecular diagnosis. In addition, maintain the QA/QC[6] program, while providing on—site assessment and training among the laboratories of the network.
10. Standardize and disseminate technical publications (i.e. outbreak control guidelines), to improve quality and effectiveness during the implementation of the sustainability strategies and actions. In addition, develop new surveillance tools, modelling approaches and mapping techniques for identifying unvaccinated areas.

References:

[6] Quality Assurance and Quality Control

Table 1: Summary of Progress towards AMRO Regional Targets – using indicators from the Strategic Plan

Indicator	AMRO Regional Status in 2014	Comments
3. No. (%) of countries with ***MCV1 ≥90% nationally and >80% in all districts.***	• 23/33 (70%) countries with MCV1=>90% nationally. • 18/33 (55%) countries with MCV1=>90% nationally with =>80% in all districts.	*33 countries reported MMR1 data through the 2014's 2014 (missing: Canada and the United States).*
2. ***No. (%) of countries with MCV2*** >90% nationally and >80% in all districts.	• 15/27 (55%) countries with MCV2>90% nationally. • 12/27 (44%) countries with MCV2=>90% nationally with =>80% in all districts.	*27 countries reported MMR2 data through the 2014's JRF (missing: Canada and the United States).*
4. ***No (%) of countries with RCV*** in their routine immunization program	35/35 (100%)	*All countries in the Americas have introduced RCV vaccine in their routine immunization program*
5. No. (%) of countries conducting ***SIAs with ≥80% of districts achieving ≥95%*** coverage	• BRA (missing data) • CHI (n=47 / 13.5%)[7] • DOR (n=35 /22.4%)[8] • PAR (13%) • VEN (n=146 / 74.8%)	
6. No. (proportion) of countries with annual ***measles incidence*** less than five cases per million population.	34/35 (97%)	*Canada reported 11.7 and 5.4 cases per million population in 2014 and 2015 respectively.*
7. Number of ***estimated measles deaths***, the percentage reduction since 2000, and number of deaths averted through vaccination.	• VEN 2002: (n=3) • BRA 2004: (n=2) • VEN 2007: (n=1) • ECU 2011-2012: (n=3) • BRA 2014: (n=1) • USA 2015: (n=1)	*Since 2000, a total of 11 measles deaths were reported in four countries.*
9. Number of ***estimated CRS cases***, the percentage reduction since 2000, and	99% cases averted since 2000 Cases averted through vaccination: 16,000 CRS cases per year[1]	

[7] 44 (12.7%) districts reported coverage >100%
[8] 65 (41.6%) districts reported coverage > 100%

number of cases averted through vaccination		
10. No. (%) of priority countries providing ***≥ 50% op costs for MCV SIAs***	32/33 (97%)	*Among countries that have implemented SIAs (n=33), Haiti is the only one who needs full financial support for operational costs and procurement of vaccines and other biologicals.*
10. No. (%) of MCV ***SIAs that include additional child health interventions***	5/6 countries (83%) administered oral polio vaccine and deworming medication	
12. No. (%) of countries conducting ***routine immunization and AEFI training as part of SIA training***	33/33 (100%)	All Latin America and Caribbean (LAC) countries use technical guidelines for SIA's planning and training.
13. No. (%) of priority countries holding a ***MR surveillance review***	33/33 (100%)	*All LAC and Caribbean countries conduct annual or biannual MR surveillance.*

Table 2: Measles supplementary immunization activities (SIAs) by country, 2014-2015*

Country	Year	Age group targeted	Children reached in targeted age group		Target number	Vaccine used
			No	%		
Argentina	2014	1-4yr	2,347,019	82	2,865,714	MR + OPV
Brazil	2014	1-4yr	9,805,805	89	10,990,802	MMR + OPV
Paraguay	2014	1-5yr	535,703	72	738,619	MMR +OPV
Venezuela	2014	1-5yr	2,466,543	99	2,479,348	MMR + OPV
Chile	2015	1-5yr	1,005,221	81	1,240,584.00	MMR
Dominican Republic	2015	1-4yr	742,792	95	778,878	MR

*Data as of February 23, 2016

Table 3: Measles and rubella performance indicators, The Americas Region, 2012-2015*

Indicator	2012	2013	2014	2015
% Notification sites[1]	79	70	87	81
% suspected cases with adequate investigation	81	88	81	80
% suspected cases with adequate blood specimens	97	86	88	83
% of specimens in lab ≤ 5 days	80	78	80	77
% serology lab results ≤ 4 days of receipt	84	71	72	71

*Data as of February 23, 2016

2.7 Country Studies

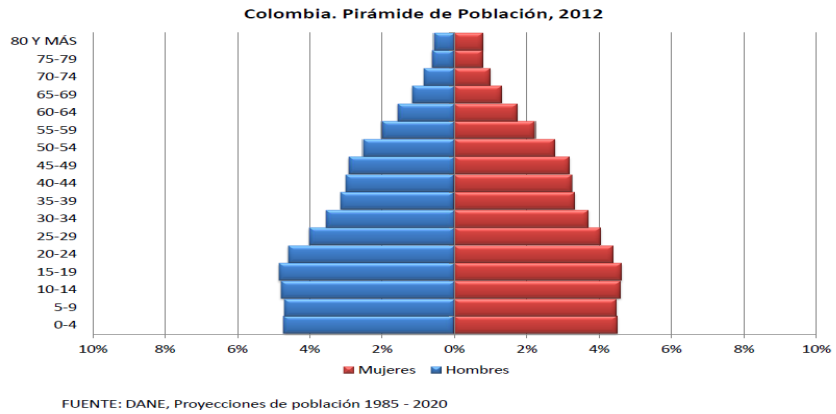
COLOMBIA

Demographic indicators:

Colombia is a country in South America with a total area of 2,070,408 km^2, of which 55.1% (1,141,748 km^2) is land and 45% is sea. It is divided into 32 departments and 1,122 municipalities. Municipalities are the smallest administrative unit.

Colombia has an estimated 47,700,000 people, with a population pyramid that shows a demographic transition toward relative aging (Figure 2).

Figure 2. Population pyramid

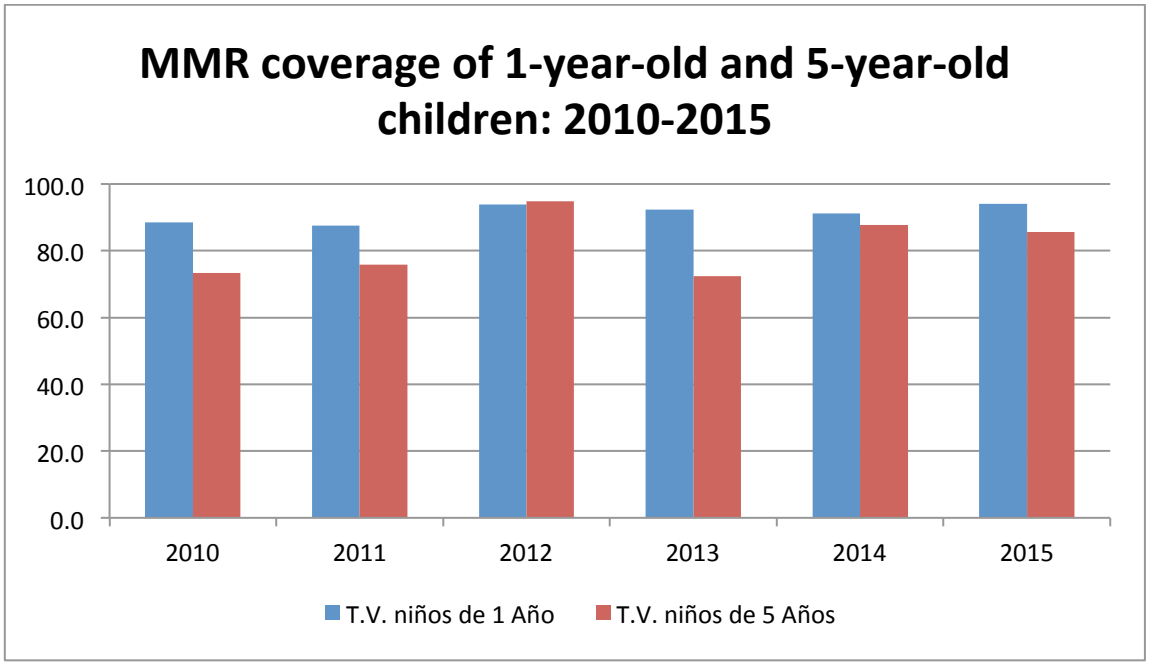


[Top: Colombia. Population pyramid, 2012; left: 80+; bottom: Source: DANE, population projections, 1985-2020]

Summary of progress towards regional measles/rubella targets as of 2014 (WUENIC and JRF data).

Vaccination coverage: Routine program 2010-2015

	2010	%	2011	%	2012	%	2013	%	2014	%	2015	%
MMR1 : 1-year-olds	757,069	88.5	752,053	87.6	740,123	93.8	732,888	92.4	707,886	91.3	702,856	94.0
MMR2 : 5-year-olds	626,055	73.4	646,922	75.8	740,123	94.7	571,070	72.3	680,231	87.8	660,360	85.7



[Graph legend: blue: MMR1: 1-year-old children; bottom, red: MMR2: 5-year-old children]

Summary of vaccination campaign targets:

- 1995: 1,509,734 children 1-3 years old were vaccinated with MMR (90% coverage)
- 1999: 2,359,865 children aged 1-4 years old were vaccinated with monovalent measles vaccine (81% coverage)
- 2002: 3,219,987 children aged 1-4 years old were vaccinated with monovalent measles vaccine (87% coverage)
- 2005-2006: 17,619,141 adolescents and adults aged 14-39 years old were vaccinated with MR vaccine (96.6% coverage)
- 2006: 2,125,895 children aged 1-5 years old were vaccinated with MR vaccine (49% coverage)
- 2010: 6,406,167 children aged 1-8 years old were vaccinated with MR vaccine (93.5% coverage)
- 2011: In the context of the U-20 World Cup Soccer Championship held in Colombia, and following the detection of a measles outbreak in the city of Barranquilla, the Ministry of Health launched a vaccination campaign targeting adolescents and young adults, aged 10-20 years old. During this campaign, 7,752,514 young people were vaccinated with MR vaccine; administrative coverage was 88.4%. Rapid coverage monitoring showed that 97% of adolescents interviewed were vaccinated. In addition, high-risk populations were vaccinated (i.e. hotel workers, medical staff, transport workers, and logistics workers, among others): a total of 106,870 people aged 18-39 years old were vaccinated.

Five key strategies

Has the country achieved and maintained high population immunity through vaccination with 2 doses of M/MR/MMR vaccine?

Analysis of vaccination coverage, by cohort (national level):

Table 4 (see below) presents national administrative coverage of 1966-2015 birth cohorts. Vaccination coverage is shown for each cohort, according to the different vaccination strategies and types of vaccine.

In summary, the table shows:

- 1966-1992 birth cohorts had ≥ 95% coverage against measles. For rubella, only the 1992 cohort showed coverage ≤ 95%.
- Coverage of the 1993-2001 cohorts was below 95%. For this reason they were considered eligible for the 2011 vaccination campaign, following the measles outbreak in Barranquilla. In 2011, vaccination was initiated in nine departments, four districts, and two cities and the rest of the country was completed during the first half of 2012. Coverage achieved was 88.4%. Rapid monitoring of vaccination coverage in this campaign showed > 97% coverage in all cohorts.
- All cohorts born between 2002 and 2009 showed administrative coverage of 93.5-94.7%, except the 2005 and 2008 cohorts, which had over 95% coverage. Rapid coverage monitoring showed that 97% of adolescents interviewed were vaccinated.
- Lower administrative coverage of the first dose of MMR was observed in the 2010 and 2011 birth cohorts (88.6% and 87.6%, respectively). In 2012, coverage rose again, to 93.8%.
- Increased administrative coverage of the first and second doses of MMR was observed in the 2012 and 2015 cohorts (94% for MMR1 and 85.7% for MMR2 in 2015).

Table 4.

Source: Monthly reporting form

TABLA - Coberturas de Vacunación por Cohorte de Nacimiento, por Estrategia de Vacunación y Vacuna, Colombia, 1966 a 2015

AÑO DE NACIMIENTO	VACUNACIÓN PERMANENTE (ANTISARAMPIONOSA - SRP- PRIMER REFUERZO)			Jornadas de Vacunación										COBERTURA MAS ALTA CONTRA SARAMPIÓN EN JORNADA	COBERTURA MAS ALTA CONTRA RUBÉOLA EN JORNADA	Monitoreos de Cobertura	EDAD EN AÑOS 2011	EDAD EN AÑOS 2015
	SRP 1ra dosis	SRP Refuerzo	ASAR	SR			SRP				ASAR							
				2010	2006	2005	2015	1997	1996	1995	2002	1999	1993					
2015	94,0	85,7																1
2014	91,3	87,8																2
2013	92,4	72,3																3
2012	93,8	79,7																4
2011	87,6	75,8																5
2010	88,5	87,8												88,5	88,5			6
2009	88,6	72,3		93,5										93,5	93,5	97,8	2	7
2008	95,2	79,7		93,5										95,2	95,2	97,8	3	8
2007	92,9	75,8		93,5										93,5	93,5	97,8	4	9
2006	94,7	74,4		93,5										94,7	94,7	97,8	5	10
2005	95,6	73,4		93,5	48,6									95,6	95,6	97,8	6	11
2004	94,4	70,0		93,5	48,6									94,4	94,4	97,8	7	12
2003	92,1	70,3		93,5	48,6									93,5	93,5	97,8	8	13
2002	93,0	92,7		93,5	48,6									93,5	93,5	97,8	9	14
2001	93,3	83,4			48,6						86,9			93,3	93,3		10	15
2000	88,2	84,2									86,9			88,2	88,2		11	16
1999	79,5	93,4									86,9			93,4	93,4		12	17
1998	78,5	87,7									86,9	80,9		87,7	87,7		13	18
1997	79,8	86,3										80,9		86,3	86,3		14	19
1996	90,1											80,9		90,1	90,1		15	20
1995	95,0		72,5									80,9		95,0	95,0		16	21
1994			84,5							90,0				90,0	90,0		17	22
1993			94							90,0				94,0	90,0		18	23
1992										90,0			97,0	97,0	90,0		19	24
1991						96,6							97,0	97,0	96,6		20	25
1990						96,6							97,0	97,0	96,6		21	26
1989						96,6							97,0	97,0	96,6		22	27
1988						96,6							97,0	97,0	96,6		23	28
1987						96,6							97,0	97,0	96,6		24	29
1986						96,6			97,0				97,0	97,0	97,0		25	30
1985						96,6			97,0				97,0	97,0	97,0		26	31
1984						96,6			97,0				97,0	97,0	97,0		27	32
1983						96,6		90,0					97,0	97,0	96,6		28	33
1982						96,6		90,0					97,0	97,0	96,6		29	34
1981						96,6							97,0	97,0	96,6		30	35
1980						96,6							97,0	97,0	96,6		31	36
1979						96,6							97,0	97,0	96,6		32	37
1978						96,6								96,6	96,6		33	38
1977						96,6								96,6	96,6		34	39
1976						96,6								96,6	96,6		35	40
1975						96,6								96,6	96,6		36	41
1974						96,6								96,6	96,6		37	42
1973						96,6								96,6	96,6		38	43
1972						96,6								96,6	96,6		39	44
1971						96,6								96,6	96,6		40	45
1970						96,6								96,6	96,6		41	46
1969						96,6								96,6	96,6		42	47
1968						96,6								96,6	96,6		43	48
1967						96,6								96,6	96,6		44	49
1966						96,6								96,6	96,6		45	50

Sarampión | Rubéola | Sarampión y Rubéola | Cohortes Susceptibles | COBERTURA MAS ALTA CONTRA SARMPIÓN- RUBÉOLA

EPI—

National

TABLE: Vaccination coverage by birth cohort, by vaccination strategy and vaccine, Colombia, 1966-2015					Coverage monitoring	Age in years, 2011	Age in years, 2015
Year of birth	Continuous vaccination (measles, MMR, booster dose) MMR, 1st dose MMR, booster dose M	Vaccination campaigns MR, 2010, 2006, 2005 MMR, 2015, 1997, 1996, 1995 M, 2002, 1999, 1993	Higher coverage of measles during campaign	Higher coverage of rubella during campaign			
[Bottom:]	Measles	Rubella	Measles and rubella	Susceptible cohorts	Higher coverage of measles-rubella		

Has the country developed an effective disease surveillance system supported by a WHO-accredited laboratory?

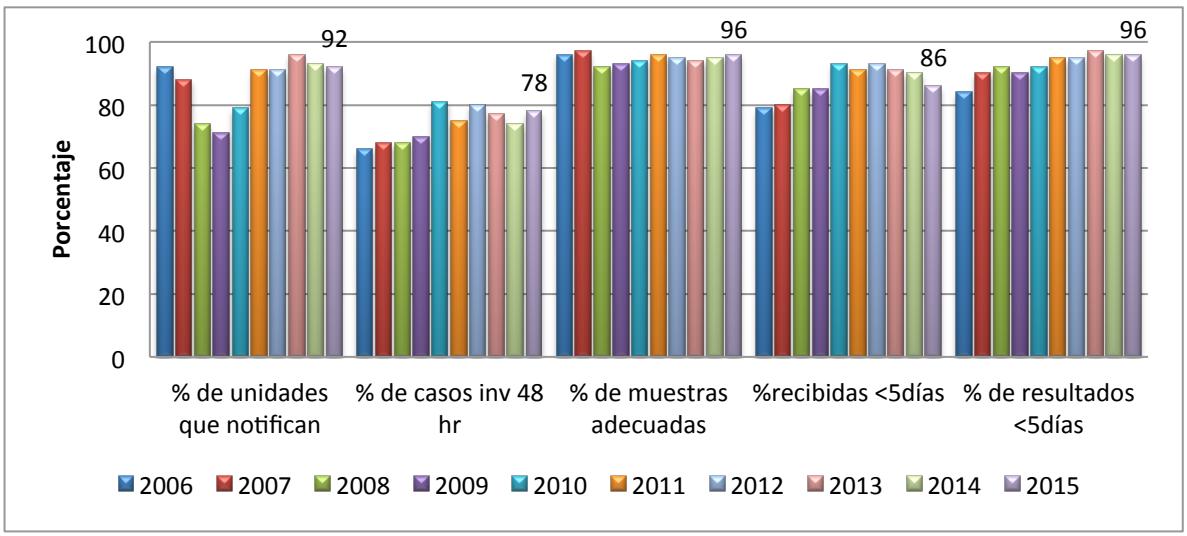
Since 1993, the country has used the PAHO's Measles Elimination Surveillance System (MESS), which captures case by case information on suspected measles cases. In 2000, data collection on suspected rubella cases began as part of the efforts to integrate the surveillance of both diseases. The software is currently installed in eight departments and the District of Bogotá, collecting approximately 91% of the data reported to the epidemiological surveillance system for vaccine-preventable diseases. Data from the rest of the country are entered at the National Institute of Health (INS for its acronym in Spanish).

In 2005, the INS began implementation of the national system for country-wide surveillance of significant events of public health interest (SIVIGILA), including the integrated surveillance of measles and rubella. SIVIGILA has different forms for measles and rubella cases, unlike MESS, which has a single form for more detailed data (so that all cases that are entered meet the criteria for suspected measles rubella cases). For this reason, the MESS database is the source of the data presented in this report.

Colombia has made sustained efforts towards meeting the surveillance quality indicators. For the period 2006-2014, on average, the country met the targets for three of the five epidemiological

surveillance indicators[9] (>80%) but not on a continuous basis. In 2015, five of the six indicators were met: percentage of blood specimens received in less than 5 days (96%); percentage of laboratory results reported in <4 days (86%); percentage of notification sites reporting on a weekly basis (92%); percentage of cases with adequate blood samples (96%); and case reporting rate, 4.79 cases per 100,000 population (projected for week 52 = 2.0). The indicator of adequate investigation was not met (78%). This is a combined indicator defined by the percentage of suspected cases with a household visit within 48 hours and the percentage of suspected cases with the following 11 data points completed: name and/or identifier, place of residence, sex, age or date of birth, date of reporting, date of investigation, date of rash onset, date of specimen collection, presence of fever, date of prior MR vaccination and travel history (Figure 3).

Figure 3. Achievement of integrated measles-rubella surveillance indicators, Colombia, 2006-2015*



* Source: INS-2015, (up to week 52 of 2015)

[Left: Percentage; Bottom, from left: % units that report; % cases investigated within 48 hrs.; % adequate samples; % received < 5 days; % results < 5 days]

In 1995, the national laboratory network for the diagnosis of measles and rubella was created. The network is coordinated by the INS, and includes 11 laboratories located in 11 departments, which are the most heavily-populated departments, share border areas, and have a high influx of tourists, among other characteristics.

As a national and international reference centre, the INS is responsible for providing training, quality control, and technical assistance to Colombia's public health laboratories, in addition to its work as a diagnostic laboratory.

[9] The indicators are: % sites reporting weekly; % of cases with adequate investigation (indicator made up of % of cases with household visit within 48 hours following reporting, and % of cases with the following eight data points); % of cases with adequate blood specimen; % of blood specimens received in laboratory in ≤5 days; and % of laboratory results reported in <4 days.

For the diagnosis of measles, rubella and CRS, the national laboratory network follows PAHO protocols. The subnational laboratories perform IgM tests for measles and rubella only.

In all subnational laboratories and the national laboratory, Enzygnost® assays are used, as recommended by PAHO/WHO for the entire network in the Region of America. Any case with positive or equivocal IgM results should always be confirmed by the national laboratory, to determine serological conversion (first, neutralization and then ELISA-IgG), differential diagnostic tests, viral isolation in cell culture, and recently, RT-PCR tests. The subnational laboratories do not send samples with negative results to the central authority.

The national reference laboratory (INS) also has the capacity for differential diagnosis of certain cases through serological tests.

The national laboratory network has guidelines for the proper shipment of samples to meet standards for biosafety and correct sample storage. Direct and indirect quality control is carried out periodically at all laboratories in the network (twice a year according to the established schedule); departmental laboratories must send 10% of samples with negative result for testing.

In addition, twice a year since 2009, the INS virology unit has been sending the departments a panel of samples for processing different serological tests for viral agents, including measles and rubella, known as the virological suitability panel (*Panel de Idoneidad en Virología—PIVI*). The panel, consisting of five sera, is sent to all departmental laboratories so that tests can be carried out at each location. Laboratories with the capacity to do IgM tests for measles and rubella have to process these samples and report the results in the established formats. In the panels sent in previous years, all sera yielded negative IgM results for measles and rubella.

However, since 2012, as a recently proposed strategy to improve monitoring and evaluation of the subnational laboratory network, a program has been implemented for external performance evaluation specifically with regard to measles and rubella. This consists of a panel of samples and a questionnaire on the surveillance, diagnosis, and laboratory analysis of these diseases, currently sent twice a year only to the 11 laboratories in the network.

Has the country been successful in conducting outbreak preparedness and response?

In the last reported measles outbreaks (Barranquilla, 2011, imported case from Brazil and Cartagena, 2015, imported case from Switzerland) there was a rapid and timely response with aggressive control measures and immediate notification of the cases, investigation within 24 hours, tracing and monitoring of contacts, active case searches (institutional and community), perimeter vaccination, and identification of unvaccinated individuals. The 2011 outbreak was limited to only six cases (one imported case and five secondary cases) and the 2015 was a single imported case.

Other innovative interventions for the control of measles outbreaks are outlined in the responses below.

Has the country developed communication strategies to build public confidence in vaccination?

The Ministry of Health and Social Protection of Colombia has conducted mass media campaigns aimed at building the Colombian people's confidence in the national vaccination program. It has conducted campaigns to promote the entire regular program on television, as well as measles and rubella vaccination, when appropriate. It has also issued specific messages to increase routine vaccine demand.

In the Barranquilla outbreak, which affected six adolescents and young adults, the country conducted a mass vaccination campaign targeting individuals aged 11-19 years old. The spokesperson for that campaign was 17-year-old Camilo Echeverry, winner of the Colombian version of "American Idol". He was very popular throughout the country and offered to support the campaign free of charge. Echeverry was vaccinated during the campaign and the message was very well received by the population. He did commercials, shows, and interviews on TV and radio, and in the press, and visited different cities to promote vaccination against measles and rubella.

In addition, due to carnival festivities in Barranquilla and neighbor cities, the country contacted the carnival queen, Ms. Gisselle Lacouture, who encouraged her peers to get vaccinated. Also, an agreement was made with Cine Colombia, the biggest chain of movie theatres in the country, to disseminate tailored messages about the importance of getting vaccinated against measles and rubella.

It is important to emphasize that all this had to be done very quickly in response to the outbreak and the communications work was done at no cost, thanks to an appeal to the social responsibility of those who gave their support. The financial investment in this topic was very small.

Furthermore, the immunization program worked hand in hand with the country's scientific and academic societies, including the Colombian Society of Paediatrics and the Colombian Infectious Diseases Association, who endorsed the Ministry's messages regarding vaccination against both diseases.

Has the country implemented innovative strategies or conducted operational research to access previously unreached communities with vaccination services and/or disease surveillance capability?

Technical cooperation agreements were established with PAHO and the International Organization for Migration (IOM): with PAHO, to offer technical assistance to prioritized, low-coverage municipalities; and with IOM, to visit departments and municipalities with teams of vaccinators, jointly reaching areas of the country with the poorest and most vulnerable populations, such as displaced populations, indigenous peoples, and other high-risk groups.

1. What were/are the critical success factors?

    1. The main success factor is that, in Colombia, the EPI is a program that has significant political and economic backing as a flagship public health program of the President of the Republic.

The program has an independent line of financing that provides an adequate vaccine supply for the entire population, fully funded by the national government. In the last outbreak (2011), thanks to political backing of the program, it was possible to immediately mobilize 11,549,033,760 million pesos (approximately $USD 6 million) to purchase eight million doses of vaccine; thermoses (215,032,430 pesos [USD 114,00]) and Ministry resources allocated to regions (6,659,795,114 pesos [estimated cost in dollars: USD 3.5 million]). The campaign's operational cost at the national level was estimated at USD 1.3 million; and expenses related to social communication activities at around USD 500,000.

2. A key factor for success in containment of the outbreak was that the country's surveillance system allowed rapid identification of first imported case and establishment of the appropriate control measures, thereby preventing further spread of the disease to many contacts.

3. Another factor in the success of the youth campaign was having a spokesperson who was recognized and well-respected by Colombian families all over the country, and who was the same age as the target audience of the vaccination campaign.

4. Churches also gave support. Because the outbreak was detected in a Christian church in Barranquilla, the target population was first approached by setting up a vaccination stand outside of the church after one of its services, but there was not a good response from adolescents and young adults. However, the church's minister was approached and, in a later service, he invited adolescents and young adults to get vaccinated at a stand set up on church property, resulting in 99% coverage of this population group. This served as the basis for work with church ministers and priests to ensure better vaccination coverage in the campaign's target population.

5. Intersectoral coordination with the Ministry of Education: The vaccination campaign during the last outbreak was carried out in the country's schools and universities, making it possible to capture the majority of this concentrated population. Again, actions were coordinated with the Ministry of Education and the entire education sector at different levels.

6. Private insurers participated actively, contributing teams of vaccinators, who spent 70-80% of the campaign in schools and universities, and the rest in municipalities, making it possible to raise the historically low participation rates of these insurers in vaccination campaigns.

2. <u>What were/are the significant barriers to achieving targets?</u>

Because the outbreak occurred in the last quarter of the year, there was not much of a budget left for wider dissemination of messages aimed at reaching a larger number of people with the invitation to get vaccinated. However, this was an opportunity to seek partners and other resources to help respond successfully.

3. <u>Conclusions and Lessons Learned</u>

What can be achieved by 2020 with current projected resources?

Colombia, like other countries in the Region of the Americas, has achieved elimination of both measles and rubella, demonstrating to the world that elimination is feasible and sustainable. As documented in this case study, strong political and community support for the routine immunization program; high levels of coverage with measles and rubella-containing vaccines; and a robust surveillance system have allowed Colombia to remain largely free of measles, rubella, and congenital rubella syndrome, despite the regular arrival of substantial numbers of travellers from regions where measles and rubella are still common. The only two relatively recent importations of measles virus known to have occurred, in 2011 and 2015, resulted in only five secondary cases in 2011 and no secondary cases in 2015. The mass immunization campaign in response to the 2011 cluster of cases, targeting those 11-19 years of age (the age group affected by the outbreak) clearly benefitted from innovative publicity and promotional activities directed at the target age group. In addition, the presence of a well-functioning surveillance program allowed Colombia both to identify the outbreak quickly and to use the descriptive epidemiologic data concerning the cases to target the at risk population.

At the same time, vaccination coverage data (not shown) suggest that some municipalities may have sub-optimal first and second dose measles-containing vaccine coverage, so future efforts are needed to eliminate coverage gaps between municipalities. Colombia also plans to strengthen further its epidemiological surveillance to assure timely detection of any future imported cases of measles or rubella and rapid implementation of containment efforts. It also plans to carry out periodic (every 4-5 years) vaccination campaigns targeting any unvaccinated, susceptible cohorts and to strengthen partnerships with academic, medical, and scientific societies in the country, so that paediatricians and other health workers will promote vaccination and those working in the private practice setting will report v

3 Eastern Mediterranean Regional Status

3.1 Regional control and/or elimination targets

a. Measles elimination target: 2020
b. Rubella target: no Regional target set

Comment:
Resolution EM/RC44/R.6 – 1997, to eliminate measles by 2010 was passed by the Regional Committee. The target date was extended to 2015 by Resolution EM/RC58/R.5 – 2011. Currently, under the Eastern Mediterranean Vaccine Action Plan, the revised target for measles elimination is 2020.

With regard to rubella elimination, the EMR has not set a regional target date for elimination. However the RTAG has recommended establishing a target date for rubella elimination in 2020.

3.2 Summary of progress towards regional targets (Table 1)

- Eleven countries of the EMR have achieved the indicator of MCV1 coverage (≥90%national level, >80% district level) and nine countries have achieved the indicator for MCV2 coverage (≥90%national level, >80% district level). The coverage estimate for MCV1 and MCV2 at national levels are taken from the WHO/UNICEF estimated coverage, while the district level coverage is taken from JRF or administrative data submitted by the country. The only exception is Palestine, for which JRF figures were used for the national coverage of MCV1 and MCV2.
- With regard to the indicator for SIA coverage of ≥95% in every district, only three countries have recently implemented SIAs that achieved such high and uniform coverage. Two of the three countries were conducting subnational campaigns for outbreak response, and for all three countries it was administrative coverage that met the criteria.
- Rubella-containing vaccine is part of the routine EPI schedule in all but five countries in the EMR. Those countries not including rubella vaccine in their routine immunization schedule are: Afghanistan, Djibouti, Pakistan, Sudan, and Somalia.
- Measles incidence remains high in the EMR; in 2014, with a measles incidence of 16 cases per million. Only eight countries in the EMR met the indicator for measles incidence <5 cases/million population in 2014.
- The estimated number of measles deaths occurring in the EMR during 2014 was 13,900, which represents a 74% decline from the number of estimated deaths due to measles in the year 2000.
- The number of congenital rubella syndrome (CRS) cases detected in the EMR during 2014 was 16. However, many countries in the region have yet to establish CRS surveillance, so this figure undoubtedly greatly underestimates CRS in the region.
- Approximately 2/3 of member countries in EMR provide at least 50% of operational cost for SIAs.
- Two thirds of countries in EMR provided other child health interventions during an MCV SIA. The most common co- administered intervention was rubella vaccine, followed by oral polio vaccine (OPV), mumps vaccine and Vitamin A. Most countries that recently implemented SIAs included

AEFI and RI training in the pre campaign training plan. However, in some emergency situations there was not adequate time to plan and conduct training over the several days needed for such training, primarily due to security concerns.

Figure 1: Measles and Rubella reported cases and MCV1/ MCV2 coverage in EMR, 1980-2014

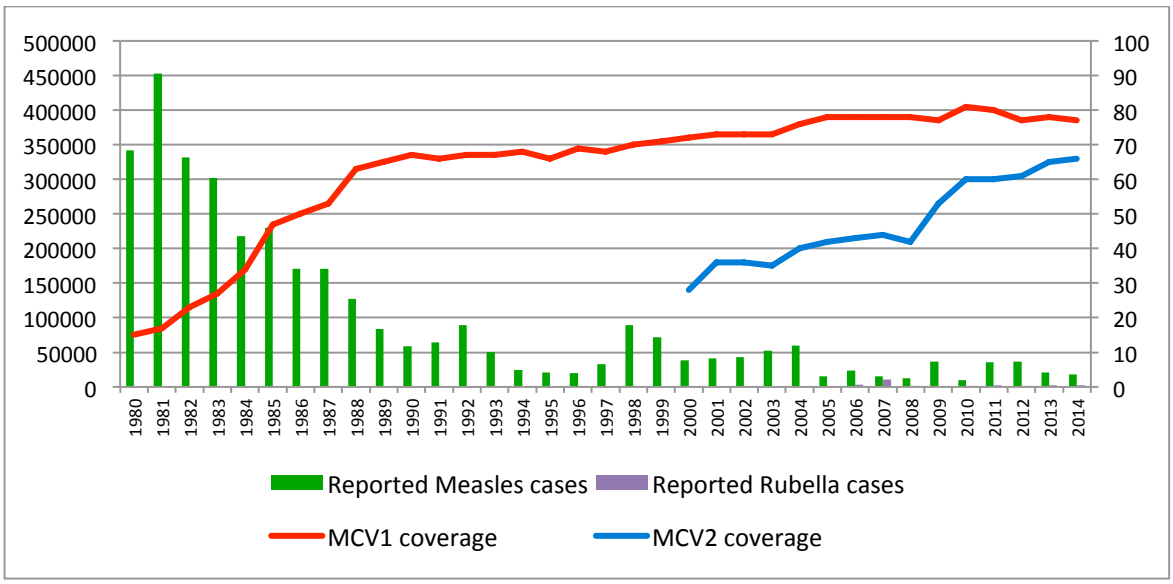
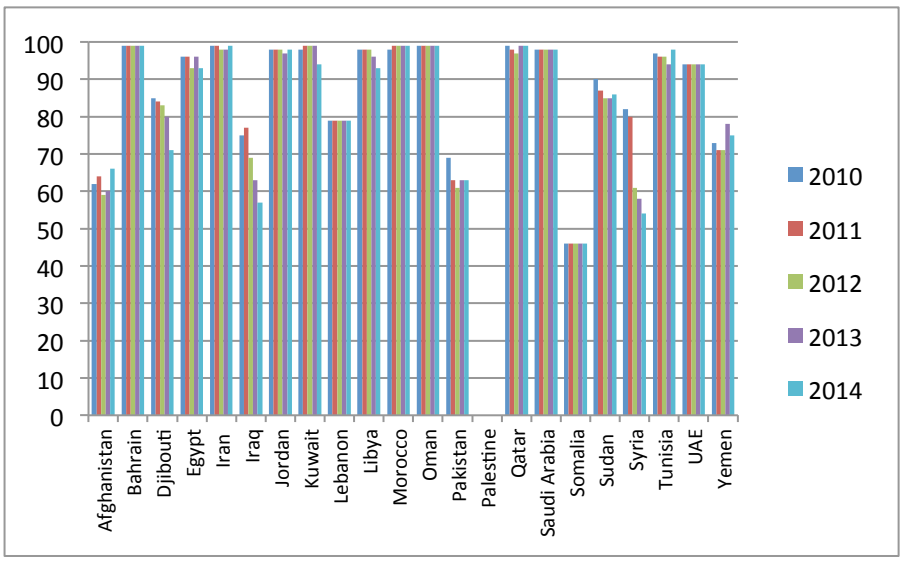


Figure 2: MCV1 Vaccination Coverage by Country in the EMR, 2010-2014*

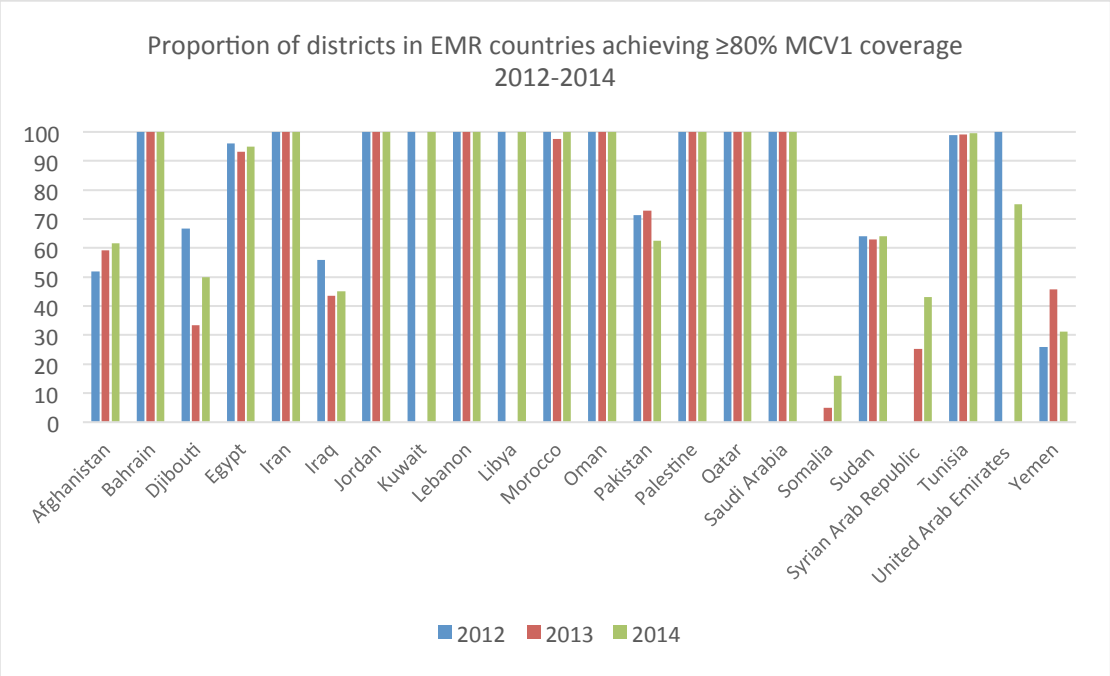


*Data source is WHO UNICEF estimates. WUENIC is not available for Palestine

- Significant progress has been made towards meeting the GVAP milestones for 2015, with a 74% reduction in mortality due to measles between 2000 and 2014. However, MCV1 coverage has stagnated at 77% since 2012. The MCV-1 coverage by country from 2012 to 2014 shows that nine countries met the GVAP goal of ≥90% MCV-1 coverage at the national level. After the

introduction of MCV-2 in all member counties of the region except Somalia, regional coverage was estimated to be 66% for the year 2014.

Figure 3: Proportion of Districts with Reported MCV1 Coverage >80% in countries of EMR, 2012-2014 *



*Data source JRF country reports

3.3 Summary on progress towards regional targets

Table 1: Summary of Progress towards Regional Targets

Indicator	EM Regional Status in 2014	Comment
4. No. (%) of countries with ***MCV1 ≥90% nationally and >80% in all districts.***	13 (75%) have national level MCV1 **≥90%** 11 (50%) have MCV1 >80% in all districts	National coverage source: WHO-UNICEF estimates, district coverage source: Country reports
5. ***No. (%) of countries with MCV2*** >90% nationally and >80% in all districts.	11 (50%) have national level MCV2 **≥90%** 9 (41%)have MCV2 >80% in all districts	National coverage source: WHO-UNICEF estimates, district coverage source: Country reports
5. ***No (%) of countries with RCV*** in their routine immunization program	17 (77%)	Countries without RCV in RI: Afghanistan, Djibouti, Pakistan, Somalia and Sudan
6. No. (%) of countries conducting ***SIAs with >95%*** in every district.	3 (14%)	Jordan (administrative coverage only), Oman for ORI, Iran for ORI
7. No. (Proportion) of	7 (32%)	Source: country reports of

countries with ***measles incidence*** less than five cases per million populations.		measles rubella surveillance data submitted to RO and calculated as measles lab confirmed + epi linked + clinical compatible/million
8. Number of ***estimated measles deaths***, the percentage reduction since 2000, and number of deaths averted through vaccination.	13,900 measles deaths 74% reduction since 2000	Source: WER, No.46, 13 November 2015
11. Number of ***estimated CRS cases***, the percentage reduction since 2000, and number of cases averted through vaccination	Data not available	
12. No. (%) of priority countries providing ***≥ 50% op costs for SIAs***	16 (73%)	All non GAVI eligible countries
11. No. (%) of MCV ***SIAs that include additional child health interventions***	14 (64%)	Source: Country self-report during ICM or SIA technical report
14. No. (%) of countries conducting ***routine immunization and AEFI training as part of SIA training***	22 (100%) countries conduct AEFI training as part of SIA training 7 (32%) included RI training as part of SIA training	Source: Country self-report during ICM or SIA technical report
15. No. (%) of priority countries holding a ***MR surveillance review between 2012-2015***	6 (27%)	Afghanistan, Bahrain, Qatar, Saudi Arabia, Sudan, Yemen - country report during ICM

3.4 Summary of implementation of each of the five key strategies

a) Achieve and maintain high levels of population immunity with two doses of measles and rubella containing vaccines

All countries in the region have introduced two doses of measles-containing vaccine into the routine immunization schedule except Somalia. Djibouti, Sudan, Afghanistan, Pakistan and Somalia have not yet introduced rubella-containing vaccine into their routine immunization schedules.

b) Monitor disease using effective surveillance

Figure 4: Distribution of confirmed Measles cases in the EMR by month 2006-2015

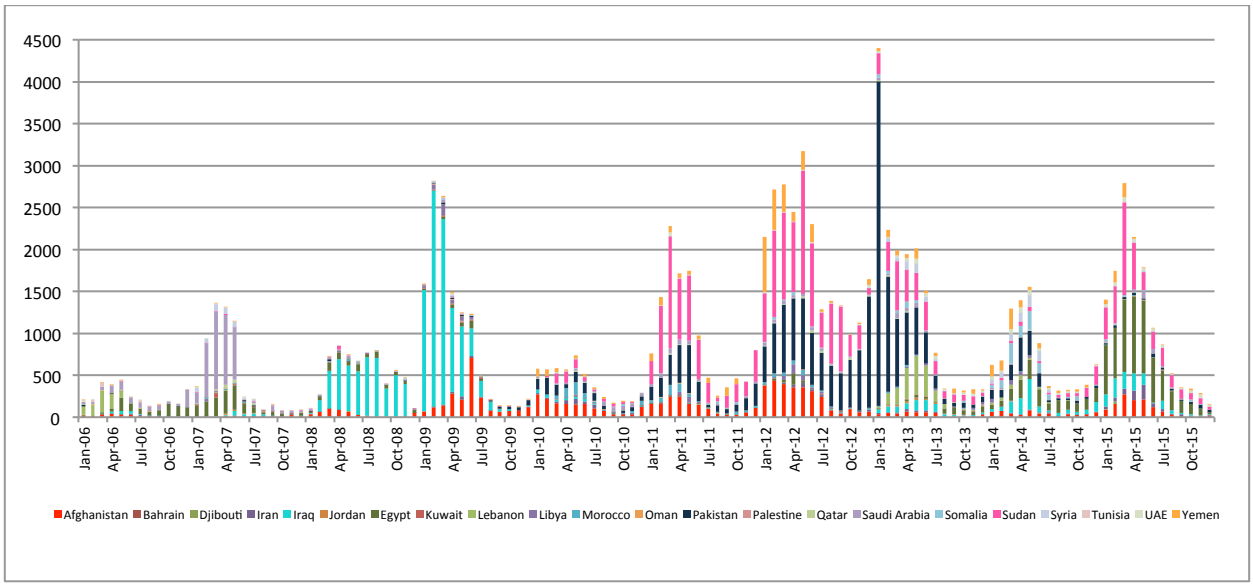


Table 2: Measles and rubella surveillance indicators

Indicator	2012	2013**	2014**	Remarks
Discarded non-measles rate[1] ≥ 2	14 (64%) 3.71	14 (64%) 2.65	14 (64%) 2.75	The number of member countries meeting the target of ≥2 Regional reporting rate
% second level units with ≥ 2 discarded cases[1]	7 (33%)	4 (19%)	7 (33%)	The number of member countries meeting the target of ≥80% Subnational units with reporting rate ≥2
% suspected cases with adequate investigation	17 (77%)	13 (59%)	17 (77%)	The number of member countries meeting the target of ≥80% cases with adequate investigation
% suspected cases with adequate blood specimens	20 (91%)	19 (86%)	19 (86%)	The number of member countries meeting the target of ≥80% cases with adequate blood specimen
% serology lab results ≤ 4 days of receipt	20 (91%)	21 (95%)	15 (68%)	The number of member countries meeting the target of ≥80% lab results within 4 days of receipt
% serology lab results ≤ 7 days of receipt	NA	NA	NA	EMRO calculates this indicator based on 4 day cut off, see above

[1] Per 100 000 population

* For this indicator the denominator is 21 because EMRO does not have subnational population figures for Libya; all other indicators have been calculated with a denominator of 22.

**In 2013 Djibouti did not report surveillance data and in 2014 Kuwait did not report surveillance data

All countries in the region have access to and use a proficient laboratory to confirm reported suspect measles and rubella cases. All countries, with the exception of Somalia and Djibouti, use a case based surveillance system, although the sensitivity and representativeness of the system vary within the region.

1. Disease Incidence

In 2014, the incidence of measles in the EMR was 16 per million. This represents a decrease from an incidence of 29 per million in the year 2013 and 42 per million in the year 2012.

Seven countries in the EMR had a measles incidence <5 per million in 2014, compared with six countries in 2013 and ten countries in 2012.

The measles genotypes reported from the EMR in 2014 were: B3, D4, and D8. Genotypes reported from the EMR in 2013 were: B3, D4, D8, and H1. The genotypes reported from the EMR in 2012 were: B3, D4, D8, D9 and H1.

The estimated number of deaths due to measles in the EMR in 2014 was 13,900. During 2014, five countries of the region reported at least one death due to measles through their surveillance system. These countries were: Pakistan, Sudan, Egypt, Iraq, and Yemen.

2. Surveillance quality as measured by indicators

During 2014, 14 countries in the EMR achieved a reporting rate of discarded non-measles non-rubella cases ≥2/100,000. The same number of countries, 14, achieved this minimum level of reporting in 2013 and 2012. Four countries failed to achieve ≥2 discarded cases/100,000 in the three year period, Djibouti, Egypt, Morocco, and Somalia. On the other hand, nine countries achieved and sustained ≥2 discarded cases/100,000 over the three year period, Bahrain, Iran, Iraq, Oman, Palestine, Qatar, Saudi Arabia, Sudan, and Yemen.

In 2014, seven countries in the EMR achieved the reporting rate of $\geq$ 2 discarded cases/100,000 in ≥80% of subnational level administrative units, compared with only four countries achieving this indicator in 2013 and seven countries in 2012.

In 2014, seventeen EMR countries achieved the indicator of adequate investigation of ≥80% of all suspect cases. This compares with 13 countries achieving the adequate case investigation indicator in 2013 and 17 countries in 2012.

In 2014, all EMR countries except for Kuwait, Lebanon, and Somalia, achieved the indicator of adequate specimens for detection of acute measles or rubella collected and tested in a proficient laboratory for ≥80% of all suspect cases. This compares with 19 countries achieving the adequate specimen collection and lab confirmation indicator in 2013 and 20 countries in 2012.

In 2014, fifteen EMR countries achieved the indicator of ≥80% of all lab results reported within four days of specimen receipt. This compares with 21 countries achieving the timeliness of reporting laboratory results in 2013 and 20 countries in 2012.

c) Develop and maintain outbreak preparedness, respond rapidly to outbreaks and manage cases;

Most countries in the region have developed outbreak response plans and are prepared to respond to an outbreak. However, smaller outbreaks are often not treated in an urgent manner, and the response occurs only after the outbreak has come to involve large numbers of cases and multiple areas of the country. Many countries having outbreaks have been directly or indirectly affected by conflict and insecurity. In emergency situations, there are often major obstacles to service delivery, delays in detection of cases, and limited accessibility that all present challenges to implementing an effective outbreak response.

d) Communicate and engage to build public confidence and demand;

The EMR participates in World Immunization Week. The region uses this initiative as a platform for increasing awareness of the benefits of immunization in general, to improve children's health, and specifically to protect them against serious diseases such as measles. Each individual country develops its own action plan for immunization week, according to its particular situation and needs.

Supplementary Immunization Activities (SIAs) present opportunities to create awareness about measles and the benefits of immunization. A communication plan is always formulated in each country preparing for an SIA, and these plans are implemented before and during the time of SIA implementation. Communication centred around the time of SIAs creates awareness not only about the specific immunization campaign but also about the risk of measles, proper case management, the benefit of vaccination against measles, and the benefit of immunization in general.

e) Research and development to support cost-effective operations and improve vaccination and diagnostic tools.

The Punjab province of Pakistan is developing an innovative monitoring tool to improve routine immunization coverage and potentially raise MCV1 and MCV2 coverage.
Absenteeism of staff in EPI outreach sessions has been recognized as one important factor underlying low vaccination coverage in Pakistan, where MCV1 coverage is estimated to be 63% and MCV2 coverage 53% (2014 WHO UNICEF est.). In order to overcome this obstacle, a program is currently in progress to track the attendance of vaccinators on outreach visits by using Android cellular phones to mark their daily position. As the vaccinator logs in to a software program installed in his official cell phone, his location is sent to web-based software and displayed on a dashboard that has been developed locally. The district and provincial supervisors have access to this web-based attendance sheet to monitor and give feedback to the individual accordingly. Since this system has been enacted, staff attendance has improved almost 50%. One limitation of this system is that it only detects the location of the vaccinator and does not give information on the quality of the vaccination session. In order to overcome this limitation, the program has been expanded to

allow the vaccinator to enter the number of antigens administered and take photos of children vaccinated. Impact on vaccination coverage has not yet been evaluated.

3.5 Successes and failures in applying the four basic principles

a) Country ownership & sustainability

All countries in the region have included costing of MCV1 and MCV2 in their immunization plans /cMYPs in addition to costing for basic MR surveillance. Sixteen countries in the EMR are self-reliant with regard to financing their EPI programs. However Somalia, Djibouti, Sudan, Yemen, Pakistan and Afghanistan remain dependent on external financial support, with varying levels of respective government financing to maintain the EPI in their countries.

b) Routine immunization and health system strengthening

Routine immunization skills are enhanced through training of health workers to implement SIAs. Even basic training for measles SIAs must include safe injection practice, vaccine management and AEFI. This information is immediately transferable to use in the routine immunization program and serves to refresh the knowledge of health care workers and build capacity.

SIAs can also strengthen the health system by augmenting the cold chain system in country. The new cold chain equipment remains in the field to be utilized by the routine immunization system.

c) Equity

Preparations for all SIAs involve comprehensive microplanning of hard to reach, rural populations, urban slum areas, and typically underserved populations. Microplanning for SIAs enhances equity by requiring mapping and planning for geographically difficult to access areas and marginalized populations. The SIA microplan can be modified for use in routine immunization, especially outreach service delivery.

d) Linkages

Field workers of the Polio Eradication Initiative (PEI) in Pakistan, Somalia, and Afghanistan have made significant contributions towards strengthening the implementation of measles SIAs. They have supported microplanning, training, and intra campaign monitoring. PEI field workers have been used to support the implementation of Child Health Days in Somalia, which has been an important mechanism for delivering MCV.

There is also linkage of MR surveillance with the AFP surveillance system in Afghanistan. Over 600 AFP reporting sites have been instructed to report suspect measles cases, including reports of zero cases.

The most common linkage of measles immunization activities with other child health interventions in EMR is that of co-administration of Vitamin A during routine immunization with MCV1 and MCV2 and during measles SIAs. In Somalia, measles vaccine is administered as part of Child Health Days, during which other routine vaccines, Vitamin A, and deworming medicine may be administered simultaneously.

3.6 Success factors enabling progress

1. High community demand for vaccination is present in many EMR countries
2. A national measles-rubella laboratory (NML) is functioning in every country in the region; 10 countries have capacity for virus isolation and eight countries have the capacity for genetic sequencing of the virus.
3. There have been no reported cases of indigenous measles transmission in Bahrain and Palestine for over three years.
4. Despite severe conditions of insecurity, many countries in EMR conducted measles SIAs in 2014 and 2015.
5. Rubella vaccine has been introduced in all but five countries in EMR.

3.7 Barriers to achieving the targets

1. Many countries in the region have not achieved 95% coverage for MCV-1 and MCV-2 at both the national and the sub-national level.
2. Low visibility of the measles elimination target
3. Weak surveillance systems for vaccine-preventable diseases
4. Poor immunization data quality
5. Insufficient or delayed use of data for action
6. Widespread insecurity in the region, resulting in reduced access to populations residing in security compromised areas
7. Lack of funding for implementation of follow-up SIAs
8. Restricted vaccine availability

3.8 Conclusion

The current insecurity and the resultant social disruption create much uncertainty and restrict the ability to conduct long term planning.

In order to eliminate measles by 2020 in EMR, there must be substantial strengthening of routine immunization systems and improved case-based surveillance system throughout the region.

3.9 Country Case Studies - Egypt

1. Demographic Data

Table 1: Demographic data for Egypt

Total population	83,387,000
Live births (LB)	1,902,000
Children <1 year	1,868,000
Children <5 years	9,273,000
Children <15 years	25,838,000
Women of child bearing age (15-49 years)	21,347,000
Neonatal mortality rate	14 (per 1000 LB)
Infant mortality rate	22 (per 1000 LB)
Under-five mortality rate	27 (per 1000 LB)
Maternal mortality ratio	45 (per 100000 LB)

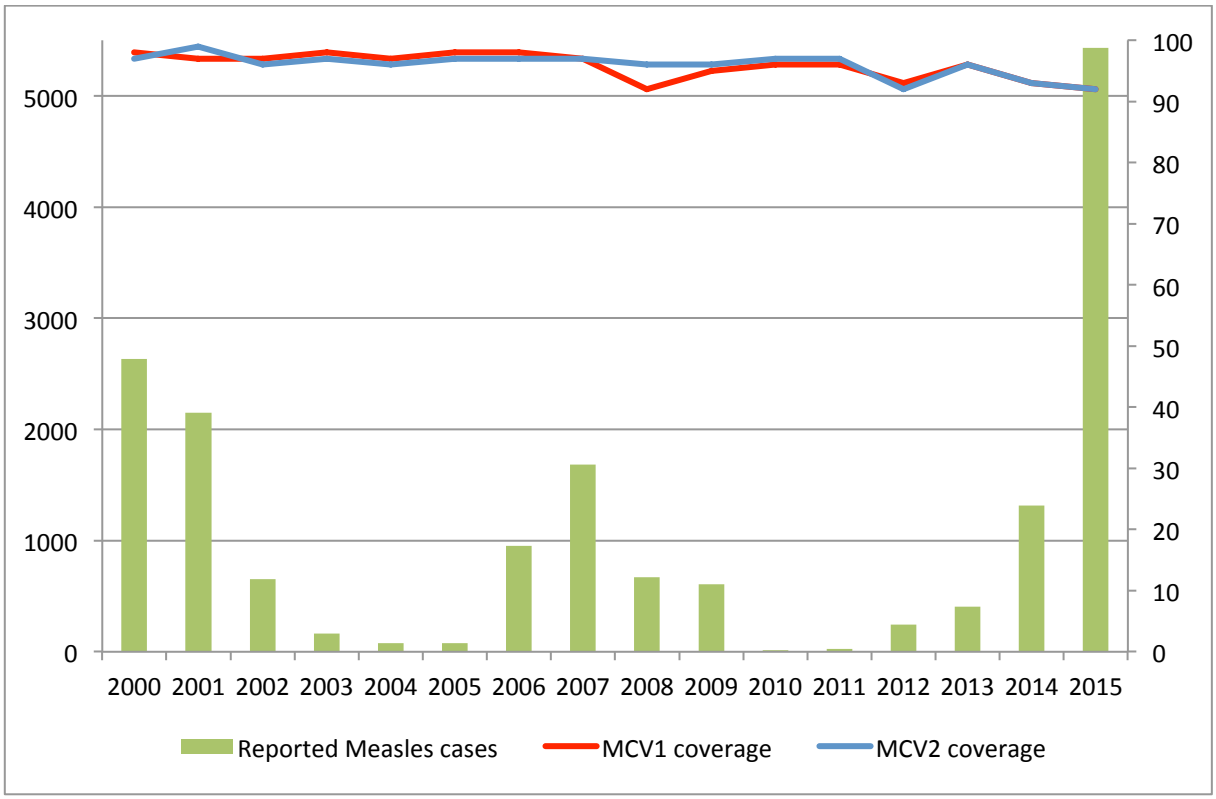
Province	27
District	279
Population density (per sq. km)	87
Population living in urban areas	43%
Population using improved drinking-water sources	99%
Population using improved sanitation	96%
Births attended by skilled health personnel	92%
Neonates protected at birth against NT	86%
Total expenditure on health as % of GDP	5%

Egypt is located in the eastern corner of North Africa and is the third most populous country in Africa. The country shares borders with Libya, Sudan, Israel and Gaza and has long coastlines along the Mediterranean and Red Seas. Although the average population density for the country is 87, this figure includes vast desert areas. Population density in the inhabited areas is 1109 and in Cairo, population density reaches 48,325 persons/km2. Slightly more that 30% of the population is under 15 years of age.

2. Summary of progress towards regional measles/rubella targets as of 2014 (WUENIC and JRF data).

The government of Egypt is highly committed to the EPI program and considers it the backbone of the preventive health program. Egypt has demonstrated its ability to successfully implement disease elimination and control programs by achieving neonatal tetanus elimination in 2007 and by stopping endemic transmission of wild polio virus by 2004. The country was steadily progressing towards measles and rubella elimination after the SIA in 2008-2009, but recently suffered the setback of a large measles outbreak in 2014-2015 following a drop in routine immunization coverage.

Figure 1: MCV1 & MCV2 % coverage and Measles cases, Egypt 2000-2015



3. Five key strategies

a. Has the country achieved and maintained high population immunity through vaccination with two doses of M/MR/MMR vaccine?

Achieved but not maintained----

The national EPI began in Egypt during the 1950s with the introduction of BCG and diphtheria antigens, followed by introduction of polio and DPT vaccines in the 1960s. Measles vaccine was first introduced in 1977 and was administered at the age of nine months. The second dose of MCV was added to the routine schedule in 1999 as MMR vaccine administered at 18 months of age. In 2008, the EPI schedule was updated to administer two doses of MMR at 12 months and 18 months of age. After 1985, there was a progressive increase in MCV1 coverage from 50% up to 95% administrative coverage in 1998. For the period of 2000 to 2011, the national MCV1 coverage remained at or above 95%, with the exception of the year 2008, when MCV1 coverage dipped to 92%. More recently, national MCV1 coverage in 2012 and 2014 fell to 93%. The most recent data from 2014 show MCV1 and MCV2 administrative coverage to be 93% at the national level. However, 5% of districts in Egypt had MCV1 coverage below 80% and 8% of districts had MCV2 coverage below 80% in 2014.

A nationwide MR SIA was implemented in two phases during 2008-2009 in response to an outbreak of measles in 2006-2007, during which the majority of cases were in those ≥5 years of age. The first phase of the SIA, completed in December 2008, for the 10-20 year old age group, achieved a national administrative coverage of 99.8% and an assessed coverage of 96%. The second phase,

completed in early 2009, for the age group 1 to 10 years, achieved an administrative coverage of 104%. During the 2001-2003 interval, school vaccination was implemented for those six years of age.

More recently, a nationwide MR SIA for the age group nine months to ten years was implemented in November 2015, achieving a reported coverage of 102%. Administrative coverage above 95% was achieved in 91% of all districts of Egypt.

Table 2: Measles/Rubella Supplementary Immunization Activities in Egypt, 2000-2015

Year SIA conducted	Target age	Target population	Reported coverage
Measles antigen			
2000-2001	6 mo -11 years	7,386,000	96%
2002-2003	11-16 years	6,670,000	96%
MMR			
2001-2002	6 years cohort	1,683,000	96%
2002-2003	6 years cohort	1,526,000	95%
2003-2004	6 years cohort	1,569,000	97%
MR			
2008	10-20 years	18,397,660	99.8%
2009	12 mo -10 years	17,200,000	104%
December 2014	9 mo - 7 years Matruah Governate outbreak response	106,395	101%
November 2015	9 mo – 10 years	23,000,205	102%

Although Egypt made great efforts to maintain high population immunity, they were unable to sustain 95% MCV coverage at the national and district levels for long periods of time. There was a drop in routine immunization coverage, partially due to a shortage of MMR vaccine between 2012 and 2014. The period between 2011 and 2014 was one of political instability and civil unrest, and this was the main factor behind vaccine shortages and a consequent fall in routine immunization coverage.

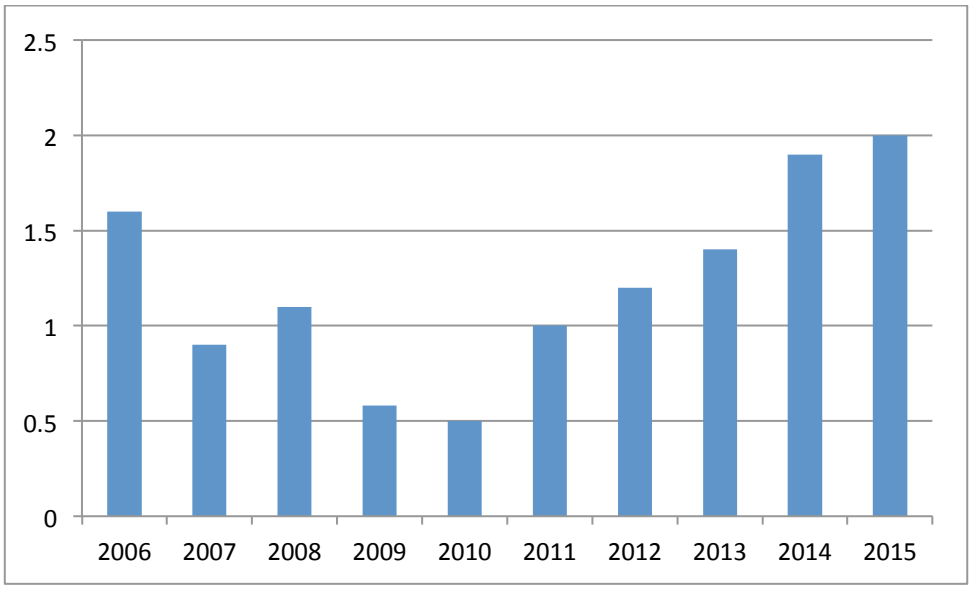
The large birth cohort and very high population density in the urban governates were underlying conditions that made measles outbreaks likely if MCV coverage fell below 95% or the time period between follow up SIAs was greater than five years.

b. Has the country developed an effective disease surveillance system supported by a WHO accredited laboratory?

Yes, but the surveillance system needs strengthening. Surveillance for febrile rash illness is performed as part of the national communicable disease surveillance system under the Division of Communicable Disease Control of the Ministry of Health. Suspected cases of measles/rubella are reported and investigated at the district level, and data flow from the district to the governate to the national level. Surveillance officers from the Division of Communicable Disease Control are responsible for the investigation of outbreaks at the district level, with oversight from the governate level.

There is good coordination between the field and laboratory surveillance teams. The Public Health Laboratory of Egypt is fully accredited and is one of the strengths of the surveillance system. The laboratory has the capability for serologic testing and virus detection, isolation and sequencing. Since 2009, the surveillance system has performed well with regard to meeting the targets for laboratory confirmation and case investigation, maintaining a level well above 80% of all suspect cases with adequate investigation and adequate specimens tested in the accredited laboratory. The timeliness of specimen receipt and laboratory result reporting has also met targets for most years. However, the national rate of reporting discarded non measles non rubella cases in Egypt remained below the target of 2/100,000 population until it was achieved in 2015.

Figure 2: Rate per 100,000 population of reporting discarded non measles non rubella cases in Egypt, 2006-2015.



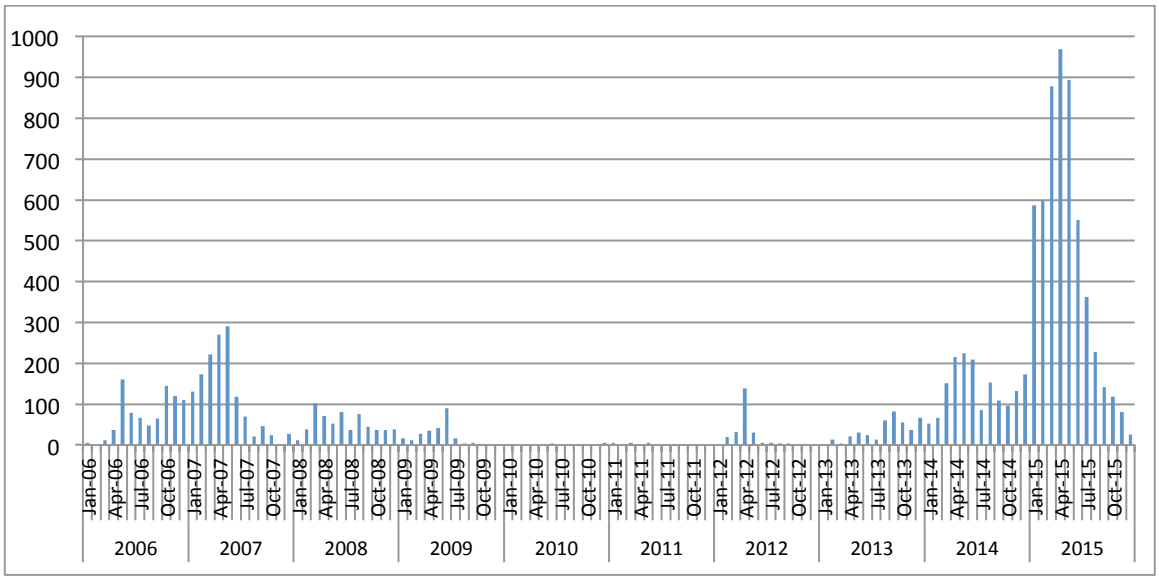
Egypt has yet to achieve the surveillance target for representativeness of reporting, reaching only 74% of subnational administrative units achieving a discarded non measles non rubella reporting rate ≥2/100,000 in the year 2014. Another weak point in the surveillance system is the relatively weak engagement of private sector health providers.

Table 3: MR Surveillance indicators, Egypt 2012-2015

Year	Reporting rate discarded non measles non rubella cases/100,000	Number and proportion of Governates achieving ≥2 discarded non measles non rubella cases/100,000	Adequate investigation	Adequate lab confirmation	Lab result <4 days
2012	1.2	12 (44%)	100%	100%	100%
2013	1.4	10 (37%)	100%	99%	100%
2014	1.9	20 (74%)	89%	90%	35%
2015	2.0	15 (55%)	100%	95%	31%

c. Has the country been successful in conducting outbreak preparedness and response?

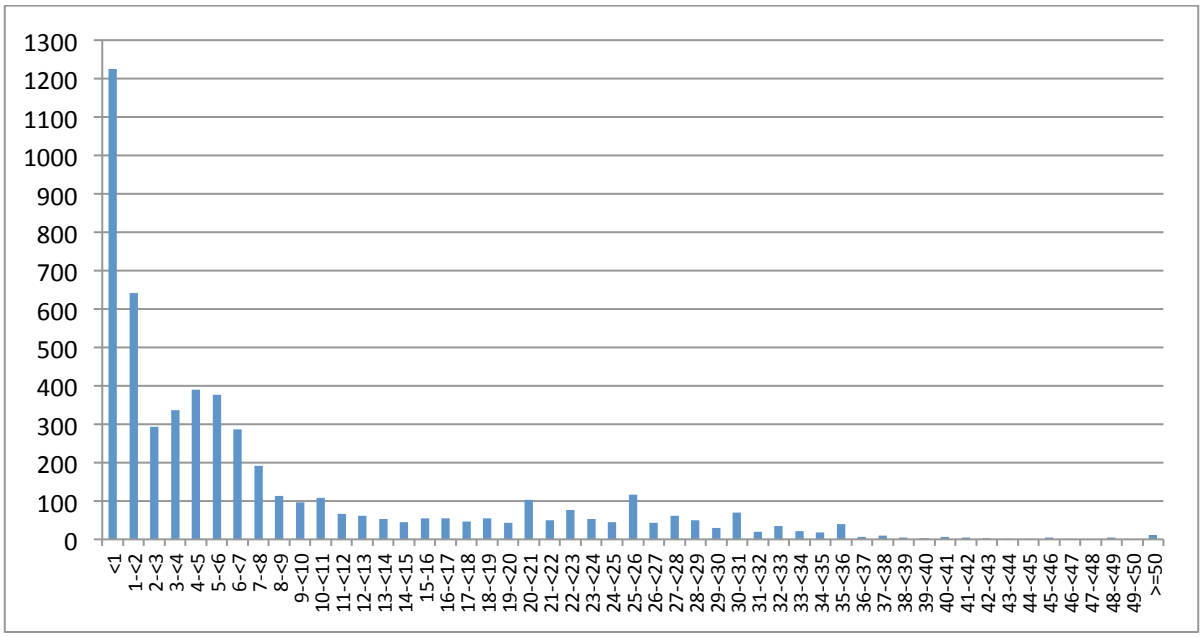
Figure 3: Distribution of confirmed measles cases by month in Egypt 2005-2015



Egypt has been partially successful in meeting objectives regarding outbreak detection and response. In 2006, an outbreak of measles occurred in the governates of Cairo, Giza, Bani Suef, Menia, Matrouh and Dakahlia. Over 60% of cases were in the age group above 5 years. The following year, outbreaks extended geographically to involve 15 governates. The last nationwide measles SIA had been conducted in two phases from 2000-2003, yielding administrative coverage of 96%. The outbreak of 2006-2007 was probably the result of an accumulation of susceptibles from missed vaccination or failure to respond to the vaccine. This outbreak was brought under control by the 2008-2009 nationwide MR SIA. The incidence of measles dropped to below 1/million in 2009 and remained less than 1/million until 2012.

In 2012, there was an outbreak of measles in the Red Sea governate following an importation from Sudan. In 2014, there were outbreaks in Matrouh and Giza governates and by the end of the year, the incidence of measles in Egypt had increased from 5/1,000,000 in 2013 to 28/1,000,000. The outbreak continued into 2015, resulting in an incidence of 61/1,000,000 for Egypt for that year.

Figure 4: Distribution of confirmed measles cases by age (years) - Egypt 2015



There were several factors that led to this outbreak. There was an accumulation of susceptible children due to missed vaccination and failure to respond to the vaccine as almost six years had elapsed since completion of the previous nationwide SIA in early 2009. Also, there was a drop in routine immunization coverage, partially due to a shortage of MMR vaccine during the period of 2011-2013, due to political uncertainty and civil unrest. These factors also contributed to a delay in the response to the outbreak, which occurred over a two year period.

Egypt's surveillance system is capable of conducting adequate investigations of suspect outbreaks, but the response has sometimes been delayed or inadequate. For example, immunization in response to the 2014 outbreak was carried out in only one governate, despite the fact that 14 governates had a measles incidence above 10. The outbreak continued into 2015, resulting in over 5,000 confirmed cases of measles. Many factors contributed to a delay in the outbreak response, including a lack of financial resources, a shortage of vaccine, competing priorities, and political instability/uncertainty. The relatively low reporting rate and the lack of representativeness of reported cases may also have led to a delay in initially detecting the measles cases and hampered the response. Similar problems are likely in the future, unless the surveillance system is strengthened.

d. Has the country developed communication strategies to build public confidence in vaccination?

Yes, but more engagement with the private sector medical community is needed. Over many years, Egypt's MOH has earned and now benefits from longstanding trust of the community in the public primary health care system. The community demand for vaccination is very high in Egypt and is one of the strengths of the EPI. Nonetheless, even in Egypt, there were anti-vaccine rumours which

circulated just before the November 2015 MR SIA. These rumours were countered by high level press conferences at national and governate levels. The rumours were also overcome at the local level by social media, interpersonal communication and other local media events. A weak link in advocacy came to light just before the start of the MR SIA, when several prominent paediatricians voiced doubts about the need for a large scale national SIA against measles. An emergency round table discussion was organized by the MOH and data on the on-going measles outbreak were presented by the EPI manager. All doubts were resolved after the data were shared, and the paediatricians came on board to advocate for the MR SIA.

e. Has the country implemented innovative strategies or conducted operational research to access previously unreached communities with vaccination services and/or disease surveillance capability?

4. What were/are the critical success factors?

Critical success factors:

1. High level of government commitment and dedicated public health workers have been important to achieve success.
2. The government of Egypt has fully funded all the EPI activities through the government budget.
3. Egypt has an active National Immunization Technical Advisory Committee to provide technical support to the immunization program
4. Strong community trust in the primary health care system and local health workers
5. Very strong community demand for vaccine

5. What were/are the significant barriers to achieving targets?

The key barriers are:

1. Inability to maintain 95% MCV1 coverage in all districts of Egypt
2. Political instability, which resulted in loss of focus on EPI service delivery and timely procurement of vaccine
3. Extremely high population density in urban areas
4. Difficult geographical access to mobile/nomadic communities in the desert frontier districts, compounded by security concerns in a few frontier districts
5. Surveillance gaps, including: areas of underreporting, weak links to private sector health care services, and incomplete documentation of outbreak investigation and response
6. General low awareness in the medical community concerning the measles /rubella elimination program

6. Conclusion

1. What can be achieved by 2020 with current projected resources

Egypt's MOH has created a solid foundation for eliminating measles and rubella and needs to build on that foundation. The current goals are achievable provided that the routine immunization coverage goals are maintained and the sensitivity of case-based MR surveillance is enhanced.

2. **What additional activities, strategies/tactics, and resources are needed to achieve or maintain the regional targets**

    - Egypt needs to close immunity gaps in the densely populated urban areas and in the mobile population living in difficult to access desert frontier states through strengthening routine immunization

    - Egypt must increase the sensitivity and representativeness of its surveillance system

    - Egypt must increase the quality of outbreak investigations and the timelessness of response

Country Case Studies - Oman

5. Demographic Data

Total population	3,926,000	Governates	11
Live births (LB)	75,000	Province/wilayat	61
Children <1 year	75,000	Population density (per sq. km)	9.2
Children <5 years	367,000	Population living in urban areas	75%
Children <15 years	889,000	Population using improved drinking-water sources	93%
Women of child bearing age (15-49 years)	819,000	Population using improved sanitation	97%
Neonatal mortality rate	5 (per 1000 LB)	Births attended by skilled health personnel	99.7%
Infant mortality rate	10 (per 1000 LB)	Neonates protected at birth against NT	98%
Under-five mortality rate	12 (per 1000 LB)	Total expenditure on health as % of GDP	2.6%
Maternal mortality ratio	11 (per 100000 LB)		

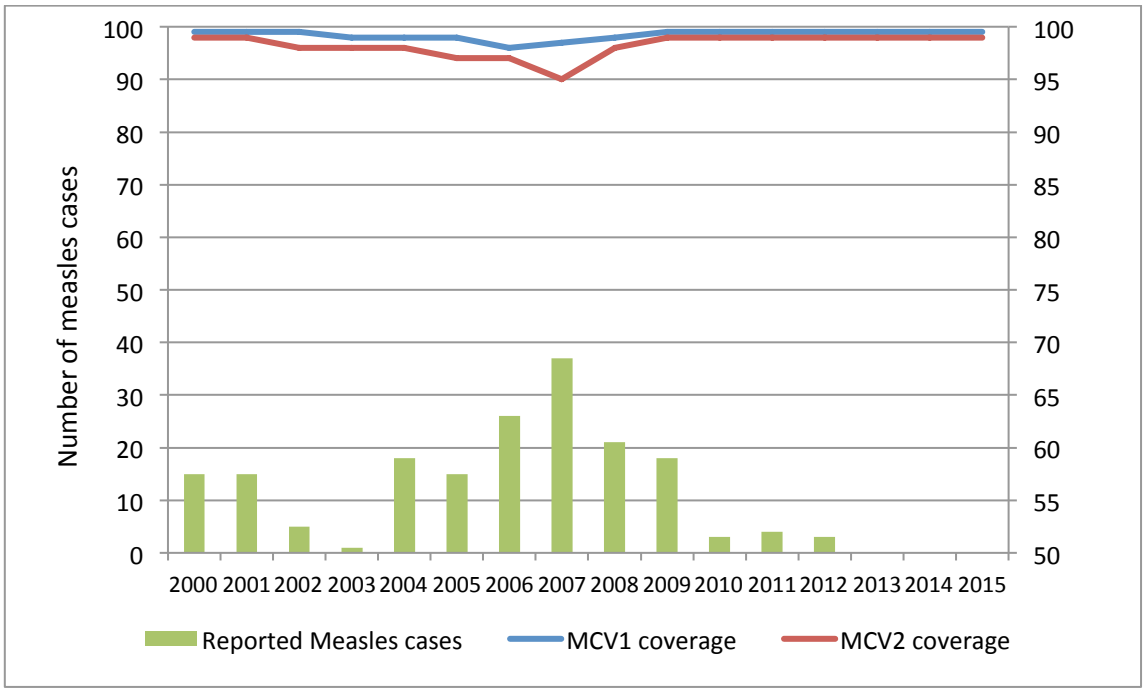
Table 1: Demographic data for Oman

Oman is located in the south eastern quarter of the Arabian Peninsula. The country shares borders with Saudi Arabia, Yemen, and United Arab Emirates and has long coastlines along the Gulf of Oman and Arabian Sea. It has a significant expatriate population, consisting mainly of guest workers from India, Pakistan, Bangladesh, Philippines, Egypt, and Jordan.

6. Summary of progress towards regional measles/rubella targets as of 2014 (WUENIC and JRF data).

Oman has made good progress towards the goal of measles and rubella elimination due to the longstanding commitment of the Government of Oman to implementation of a high quality EPI. This includes full implementation of the two main strategies for measles elimination: achieving and maintaining high population immunity and maintaining sensitive surveillance. The EPI is integrated into the primary health care system and both EPI and cold chain management fall under a single administrative office. The EPI is part of a comprehensive child health care package and dedicated staff is available in every health unit for EPI service delivery and cold chain management. There is a recognized policy to use every child contact with the health care system to deliver immunization. Immunization and laboratory testing of suspect measles cases are financed by the government and provided free of charge in government health facilities for both Omani and non-Omani residents.

Figure 1: MCV1 & MCV2 % coverage and number of Measles cases Oman, 2000-2015



7. Five key strategies

a. Has the country achieved and maintained high population immunity through vaccination with two doses of M/MR/MMR vaccine?

Measles vaccine was first introduced in Oman in 1981, and administered at the age of nine months. The second dose of measles containing vaccine was introduced in 1994 and since 1996, coverage ≥ 95% for both MCV1 and MCV2 has been sustained. Also, in 1994, a measles rubella catch-up campaign was implemented for children between the ages of 15 months and 18 years, which achieved coverage of 94%.

Data on immunization coverage are analysed at district and national levels and feedback given on a monthly basis. Data on administrative coverage are confirmed by periodic validation using the Data Quality Self-Assessment every three years and by coverage evaluation surveys every five years.

b. Has the country develop an effective disease surveillance system supported by a WHO accredited laboratory?

Oman has met or surpassed the target for all quality MR surveillance indicators for the past four years. Measles/rubella surveillance is performed as part of the national communicable disease surveillance system under the Department of Communicable Disease Control. The MOH of Oman requires all health facilities to notify suspect measles cases within 24 hours to the governate level surveillance unit. Since 2004 Oman has used the case definition of "fever and rash". All notified cases have specimens collected for simultaneous testing for detection of measles and rubella IgM. Weekly zero reporting for "fever and rash illness" has been established using the existing infrastructure for acute flaccid paralysis and neonatal tetanus surveillance.

The Oman Central Public Health Laboratory has been accredited by WHO as the Regional Reference Laboratory for measles and rubella viruses. The laboratory has achieved 100% reporting within four

days of specimen receipt for the past four years. PCR confirmation and genotyping are performed on all IgM positive samples and the laboratory has the capability for virus culture and isolation.

Figure 2: Rate of reporting* discarded non measles non rubella cases Oman 2006-2015
***per 100,000 population**

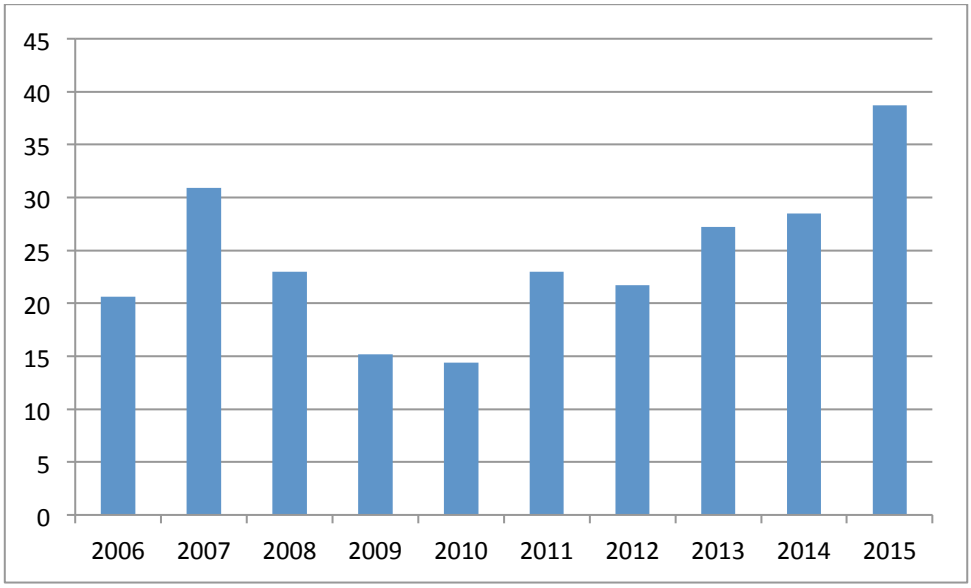
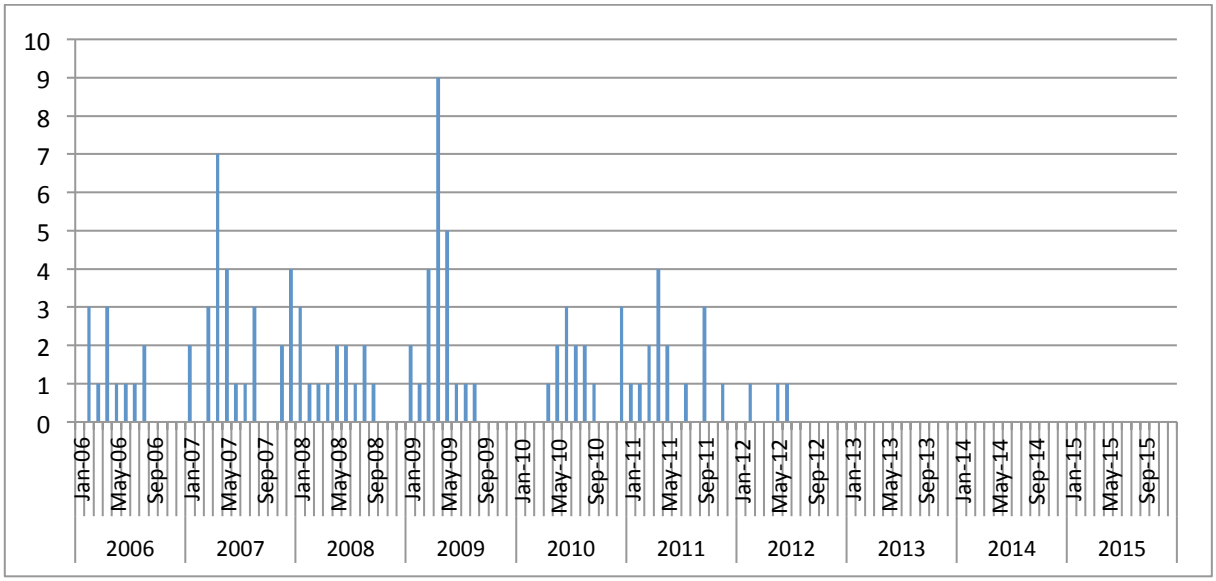


Table 2: Measles Rubella Surveillance indicators, Oman, 2012-2015

Year	Reporting rate discarded non measles non rubella cases/100,000	Number and proportion of Governates achieving ≥2 discarded non measles non rubella cases/100,000	Adequate investigation	Adequate lab confirmation	Lab result <4 days
2012	21.7	82%	97%	99%	100%
2013	27.2	91%	94%	98%	100%
2014	28.5	82%	99%	98%	93%
2015	38.7	100%	99%	98%	99%

c. Has the country been successful in conducting outbreak preparedness and response?

Figure 3: Distribution of confirmed measles cases by month in Oman, 2006-2015



Oman has maintained a satisfactory level of preparedness for measles outbreak detection and response. National guidelines define an outbreak as one clinically suspect or one lab-confirmed case of measles. The national guidelines require all outbreaks to be investigated within 48 hours and clinical specimens obtained from suspect cases and submitted to the laboratory for testing within three days. From the period 1995 to 2015, 34 outbreaks were detected. The national guidelines define an outbreak as one clinically suspected or lab-confirmed measles case. The combined total number of cases detected during investigation of these outbreaks was 45 cases.

d. Has the country developed communication strategies to build public confidence in vaccination?

Communication about vaccination is mainly delivered through the Primary Health Care system using interpersonal communication and printed communication materials.

e. Has the country implemented innovative strategies or conducted operational research to access previously unreached communities with vaccination services and/or disease surveillance capability?

One important factor to Oman's success in maintaining high immunization coverage is their comprehensive and multilayer defaulter retrieval system. Parents of children who miss a vaccination appointment at the health unit are called by the facility EPI staff. If still defaulting after two weeks' time, a home visit is made by a public health worker. If the child is still defaulting after four weeks, the case will be referred to the EPI outreach team. Again at school entry, children are screened for complete vaccination, especially with regard to measles and rubella. Two doses of MR or MMR are recommended before school entry.

8. What were/are the critical success factors?

6. Strong political commitment for high quality implementation of the EPI and measles rubella elimination strategy
7. The government of Oman fully funds all of the EPI activities and laboratory testing of suspected cases of measles/rubella. Both Omani and non-Omani residents may access immunization services free of charge in government health facilities.
8. Integration of EPI into the Primary Health Care system, with availability of EPI services at all times in all PHC centres
9. Professional and well trained EPI and epidemiology staff at the national and sub national levels
10. Fixed immunization centres established throughout the country that are augmented with mobile and outreach teams used to reach children in remote areas
11. All children are registered in the child health register of their nearest health centre and these registers are kept up to date in all MOH institutions
12. Regular monitoring of the immunization coverage at national and subnational levels, including periodic validation of vaccination coverage data using DQSA and coverage evaluation surveys every five years.
13. Integration of the measles /rubella surveillance system into the national communicable disease surveillance system and prioritizing measles within this system
14. Clear national guidelines for measles outbreak investigation
15. Oman has established an active National Immunization Technical Advisory Committee to provide technical support to the immunization program and an expert measles technical committee to review the status of measles elimination.

7. What were/are the significant barriers to achieving targets?

The key barriers are:

7. The presence in the country of a large number of non-Omani resident workers and their families. The vaccination/immunity status of non-Omanis is difficult to document and completion of the vaccination schedule difficult to enforce in the older age groups. Many resident workers originate from areas where the national EPI coverage is much lower than in Oman, and where rubella vaccine has not been introduced into the routine immunization program.
8. High population movement in and out of the country for trade and tourism
9. Difficult geographical access to mobile/nomadic communities in the desert

8. Conclusion

1. What can be achieved by 2020 with current projected resources

Due to the high commitment of the government of Oman and the diligent implementation of the measles elimination strategies, Oman is well-positioned to eliminate measles and rubella before the 2020 target date.

2. **What additional activities, strategies/tactics, and resources are needed to achieve, or maintain, the regional targets**

- Maintain high population immunity through routine immunization
- Continue to be vigilant for immunity gaps and respond appropriately to close any gaps
- In depth investigation and contact tracing of all cases to determine source of infection

4 European Region

4.1 Regional control and/or elimination targets

a. Measles elimination target - 2015
b. Rubella elimination target - 2015

In the WHO European Region the goals are elimination of measles and rubella and prevention of congenital rubella syndrome by 2015

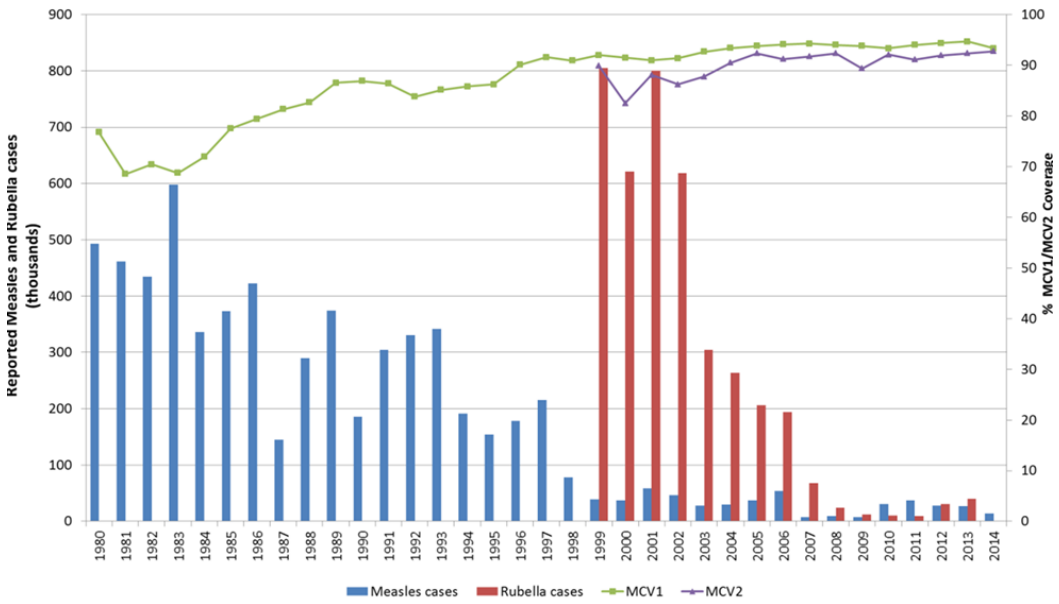
- Resolution EUR/RC48/R5 (1998) on the health for all policy framework for the European Region for the 21st century, which identified targets for nine vaccine-preventable diseases, including measles elimination by 2007 and a congenital rubella syndrome (CRS) incidence of < 1 case per 100 000 live births by 2010.
- Resolution EUR/RC55/R7 (2005) introducing rubella elimination, with target by 2010
- Resolution EUR/RC60/R12 (2010) new target: 2015

Elimination of measles and rubella is one of the top priorities for the WHO Regional Office, and one of the six primary goals of the European Vaccine Action Plan 2015-2020 (EVAP). EVAP is a regional interpretation of the Global Vaccine Action Plan (GVAP), viewed as a road-map for immunization service delivery in the European Region for the next 5 years and endorsed by the WHO European Regional Committee in September 2014.

4.2 Summary of progress towards regional targets

a. Secular trend in reported measles and rubella cases, and MCV1 and MCV2 coverage, 1980 to date

Figure 1: Measles and rubella cases and MCV1/MCV2 coverage*, WHO European Region, 1980-2014



*MCV1 and MCV2 WUENIC WHO/UNICEF estimated national immunization coverage; Measles and rubella confirmed cases as reported in annual Joint Reporting Form (JRF)

With 53 Member States in the Region, it is almost impossible to graphically present meaningful country-specific and subnational level information for long periods of time. Additional challenges persist in reporting and analysing subnational immunization coverage data. These data are not submitted by all Member States and they do not present same/equivalent administrative levels in all Member States. Instead, data from not-compatible administrative levels (some countries are presenting states, regions, municipalities) are provided. Consequently, Indicator 1 shows only national level data

The reported incidence of both measles and rubella in the Region has shown dramatic declines over the past 20 years. In the presence of improved surveillance, the number of reported measles cases has fallen from more than 340,000 in 1993 to approximately 31,000 in 2013 and 17,782 in 2014. Since 2010, large outbreaks in Bulgaria, France, Georgia, Turkey and Ukraine have accounted for a significant proportion of the total number of cases. Continuing the trend observed in recent years, approximately one third of reported measles cases have been ≥20 years of age. However, there are considerable differences in the age distribution of cases seen in different countries. In some countries, cases among health care workers are significant. Reported rubella cases have fallen from 620,000 in 2000 to fewer than 40,000 in 2013. Rubella outbreaks in Romania and Poland have accounted for almost all of the reported recent cases.

Vaccination coverage in the Region as a whole remains high, with MCV1 coverage at approximately 94%. In addition, wide-scale supplementary immunization activities (SIA) have been conducted, with 24 being reported since 2000. However, most of the measles cases are among unvaccinated or incompletely vaccinated individuals, with many cases in older age groups with unknown vaccination status.

Significant measles outbreaks were reported in 2013 and in 2014 in Azerbaijan, Bosnia and Herzegovina, Georgia, Germany, Italy, Latvia, the Netherlands, Russian Federation, Turkey, Ukraine and United Kingdom. There is a continuing large outbreak of rubella in Poland, although the number of cases began to decline in 2014. Most recent outbreaks of measles and rubella have occurred among the general population but some have been focussed on recognized under vaccinated groups.

Table 1A: Summary of Progress Towards Regional Targets – using indicators from the Strategic Plan

Indicator	Regional Status in 2014 *(please add 2015 data if available)*	Comment
6. No. (%) of countries with ***MCV1 ≥90% nationally and >80% in all districts.***	1) 42/53 (79.2%) 2) N/A	Please provide: 1. No. (%) with ***MCV1≥90% nationally*** ***2.*** No. (%) with ***MCV1 ≥90% nationally and >80% in all districts***
2. ***No. (%) of countries with MCV2*** >90% nationally and >80% in all districts.	1) 32/53 (60.4%) 2) N/A	Please provide: 1. No. (%) with ***MCV2≥90% nationally*** ***2.*** No. (%) with ***MCV2 ≥90% nationally and >80% in all districts***
6. ***No (%) of countries with RCV*** in their routine immunization program	53/53 (100%)	
7. No. (%) of countries conducting ***SIAs with ≥80% of districts achieving ≥95%*** coverage	1/2 (50%) *(2MS did MR SIA in 2014, AZE and GEO)*	
8. No. (proportion) of countries with annual ***measles incidence*** less than five cases per million population.	30/50 (60%) *(2014 Monthly reported surveillance data to CISID; no data from 3 MS; all measles cases, including imported)*	
9. Number of ***estimated measles deaths***, the percentage reduction since 2000, and number of deaths averted through vaccination.		*Available from HQ model estimates*
13. Number of ***estimated CRS cases***, the percentage reduction since 2000, and number of cases averted through vaccination		*This information may only be available from Emilia Vynnycky's model of CRS burden. HQ to follow-up with Emilia*
14. No. (%) of priority countries providing ***≥ 50% op costs for MCV SIAs***	NA	
12. No. (%) of MCV ***SIAs that include additional child***	2014 – 0/2 (0%)	

health interventions		
16. No. (%) of countries conducting ***routine immunization and AEFI training as part of SIA training***	2014 – 2/2 (100%) 2015 - 1/1 (100%)	
17. No. (%) of priority countries holding a ***MR surveillance review***	NA	*This can be as part of a national EPI program review, or a review of the surveillance system for all vaccine preventable diseases*

Table 1B: Summary of Progress Towards Regional Elimination Targets – using RVC latest report

Conclusions of the 4th RVC meeting, Oct 2015

Elimination Status	List countries that have eliminated measles	List countries that have eliminated rubella
Interrupted endemic transmission for ≥36 months	Andorra, Armenia, Azerbaijan, Belarus, Bulgaria, Cyprus, Czech Republic, Estonia, Finland, Hungary, Israel, Latvia, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Slovenia, Sweden, Turkmenistan **N=21**	Andorra, Armenia, Azerbaijan, Belarus, Cyprus, Czech Republic, Estonia, Finland, Hungary, Ireland, Israel, Latvia, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Slovenia, Turkmenistan **N=20**
Interrupted endemic transmission for ≥12 months but <36 months	Croatia, Denmark, Greece, Iceland, Lithuania, Montenegro, Republic of Moldova, Spain, Tajikistan, United Kingdom of Great Britain and Northern Ireland, Uzbekistan **N=11**	Croatia, Greece, Iceland, Lithuania, Montenegro, Republic of Moldova, Spain, Sweden, Tajikistan, the former Yugoslav Republic of Macedonia, United Kingdom of Great Britain and Northern Ireland, Uzbekistan **N=12**
Ongoing endemic transmission	Austria, Belgium, Bosnia and Herzegovina, France, Georgia, Germany, Ireland, Italy, Kazakhstan, Kyrgyzstan, Poland, Romania, Serbia, Switzerland, the former Yugoslav Republic of Macedonia, the Russian Federation, Turkey, Ukraine **N=18**	Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Denmark, France, Georgia, Germany, Italy, Kazakhstan, Kyrgyzstan, Poland, Romania, Serbia, Switzerland, the Russian Federation, Turkey, Ukraine **N=18**
No report submitted to the RVC	Albania, Monaco, San Marino **N=3**	Albania, Monaco, San Marino **N=3**

4.3 Summary of implementation of each of the 5 key strategies

a. Achieve and maintain high levels of population immunity with two doses of measles and rubella containing vaccines;

- All MS in the region have an immunization schedule with two doses of MR-containing vaccines in the routine immunization program
- Reported coverage at the national level is sustainable high for first dose, but less than 95% in about half of MS in the Region and significantly low in some of them

WHO/UNICEF coverage estimates for 2000-2014, as of 10 July 2015.																
Region	Vaccine	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
EUR	MCV1	91	92	91	91	92	93	94	95	95	94	93	94	95	95	94
	MCV2	49	63	71	79	83	82	80	82	81	78	80	82	83	84	84

- In period 2000-2015 more than 63 million people were immunized against measles, more than 33 million against rubella in different SIA
- WHO Europe key strategies incudes “provide immunization to all susceptible, using any opportunity” – and in many countries different activities were taken or under development to implement this strategy, with defining and immunizing particular groups in population (FCBA, health care workers, university students, military services, …)

b. Monitor disease using effective surveillance

Table 2: Measles and rubella surveillance indicators (if your Region does uses a different version of these surveillance indicators, please use the indicators most readily available)

WHO Europe does not use the same set of indicators. Please see surveillance indicators used as part of verification process and results from analysis of 2014 data submitted by National Verification Committees.

Table 2 Measles surveillance indicators (based on 47 NVC/countries reports for 2014)

Indicator	Number of MS achieved target	Number of MS not achieved target	Number of MS considered indicator as not applicable	Number of MS with no data, or unclear info	Target and Notes
Timeliness of reporting (to national level) (T)	28/47 (59.6%)	5/47	9/47	5/47	Target: ≥80%
Completeness of reporting (to national level) (C)	27/47 (57.4%)	5/47	9/47	6/47	Target: ≥80%
Rate of laboratory investigations (L)	35/47 (74.5%)	7/47	3/47	2/47	Target: ≥80%
Rate of discarded cases (D)	15/47 (31.9%)	24/47	2/47	6/47	Target: **At least 2 discarded measles or rubella cases per 100 000**
Representativeness of reporting discarded cases (R)	6/47 (12.8%)	24/47	6/47	11/47	Target: ≥80%
Viral detection (V)	17/47 (36.2%)	12/47	13/47	5/47	Target: ≥ 80%
Origin of infection identified (O)	28/47 (59.6%)	7/47	10/47	2/47	Target: ≥ 80%
Timeliness of investigation (I)	34/47 (72.3%)	4/47	5/47	4/47	Target: ≥ 80%
Timeliness of notification (Tn) **Not mandatory to use**	5/47 (10.6%)	9/47	3/47	30/47	Target: ≥80%

Rate of cases tested negative for measles or rubella IgM (N) Not mandatory to use	3/47 (6.4%)	5/47	2/47	37/47	Target: **At least 2 MLI/RLI cases tested negative per 100 000 population (nationwide)**

Comments: Significant number of countries are still struggling to develop comprehensive case-based measles surveillance and/or reporting of such kind of data to the WHO Regional Office for Europe. In the same time comprehensive case-based rubella surveillance does not exist in Belgium, Denmark and France, while many countries perform sub optimally. CRS surveillance in most of countries is also suboptimal.

Activities of the Regional Office:

- Strengthening of surveillance with introduction of case-based surveillance and reporting
- Stronger incorporation of laboratories, developing the reference laboratory in every country and creation and lead on Regional Ref Lab network
- Development of surveillance tools and systems at country level and at the level of WHO Europe RO
- Integration of surveillance and its development as part of existing health systems/surveillance systems

c. Develop and maintain outbreak preparedness, respond rapidly to outbreaks and manage cases;

Comments:

In the WHO European Region this strategy is part of the surveillance strategy. As any surveillance is meaningful only if its information is used for action and in many countries in the Region detection and reporting of outbreak is not followed with adequate response measures (immunization of recognized susceptible population and further activities to define susceptibility).

Activities of the Regional Office:

Developed Guidelines for measles and rubella outbreak investigation and response in the WHO European Region in 2013, a recommendations developed by WHO/Europe to help Member States address challenges to reaching the goal of measles and rubella elimination.

d. Communicate and engage to build public confidence and demand;

Comments:

- Strengthening in-country partnership and involvement of all decision makers and stakeholders
- Involvement of NGOs, professional associations, interested parties in promotion of immunization and MR elimination
- Active use of modern communication technologies
- Developing of diversity of applications at WHO Regional and country levels
- Developing communication tools
- Developing Regional and country-specific Tailoring Immunization Programs (TIP) tool
- European Immunization Week with long tradition

Activities
TIP
http://www.euro.who.int/__data/assets/pdf_file/0003/187347/The-Guide-to-Tailoring-Immunization-Programs-TIP.pdf?ua=1

EIW
http://www.euro.who.int/en/health-topics/disease-prevention/vaccines-and-immunization/european-immunization-week

e. Research and development to support cost-effective operations and improve vaccination and diagnostic tools.

EURO considers this a global strategy and not a regional function.

4.4 Successes and failures in applying the 4 basic principles (see country case studies)

a. Country ownership & sustainability
b. Routine immunization and health system strengthening
c. Equity
d. Linkages (e.g., polio eradication)

4.5 Conclusions

Discussions with EURO staff identify the following three main barriers to achieving M&RI objectives: 1) Political commitment – both at the national (Presidential or Ministerial) level and at the health system level (including WHO/HQ); 2) population attitudes to immunization – most are not against immunization but are apathetic about immunization, and do not perceive any personal risk; and 3) diversity of population and health systems in the Region – the 5-10% of unimmunized children who have not received MRCV2 is enough to sustain transmission but represent a very diverse population requiring different approaches.

- Elimination of measles and rubella transmission by 2020 is feasible in the European Region, but it seems unlikely it will be achieved
- 60% of countries in the Region have achieved interruption of measles and rubella transmission in 2014
- However, some of the largest and most developed countries (e.g., France, Germany, Italy, Russian Federation, Switzerland) have not done so. In some of these countries major problems relate to political/societal will rather than technical or financial issues. In some, security and other concerns impede progress
- Overall immunization coverage in the Region is stagnant (at 90-94%) or decreasing and MCV2 coverage is 10% lower than MCV1
- In some countries, groups of unimmunized persons (e.g., Roma) pose major programmatic challenges

5. **Recommendations**
   - Varied population/political situations within the Region necessitate development of tailored approaches to interrupt transmission
   - Case/outbreak investigation needs to be strengthened and data shared among countries in the Region; In particular, rubella and CRS surveillance needs to be strengthened
   - Improved approaches need to be developed to identify and reach "new susceptible" populations such as adolescents and adults.

4.6 Country Case Studies

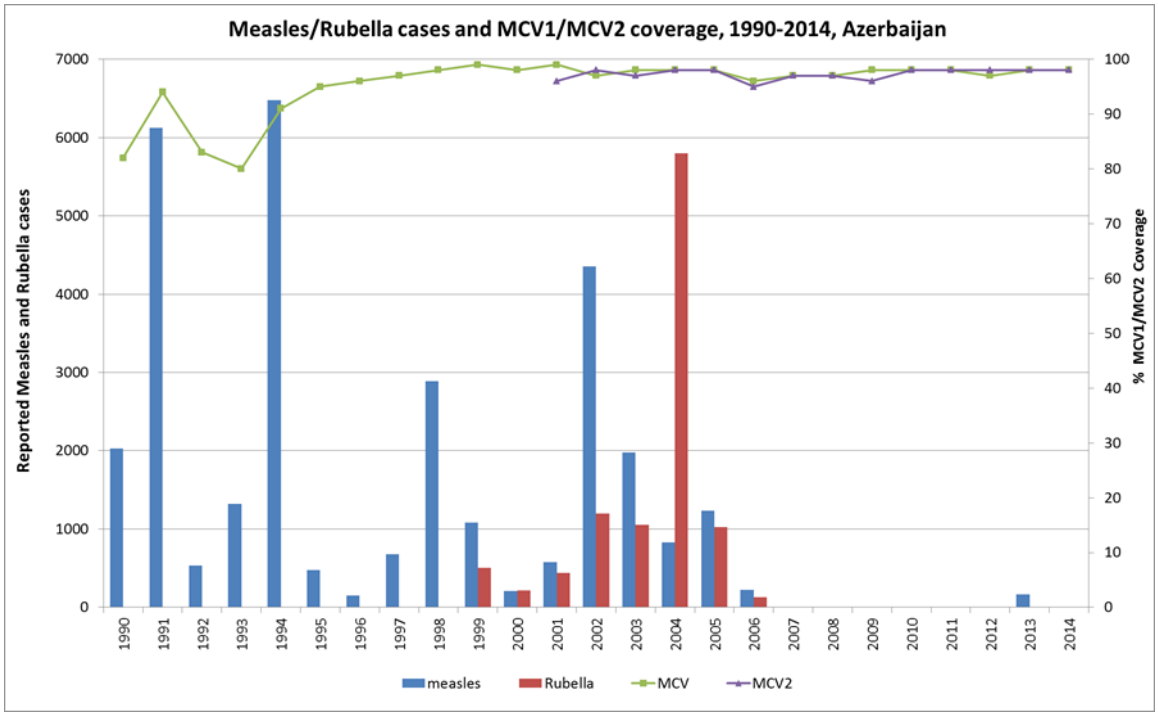
Azerbaijan

9. Country Name and demographics **Azerbaijan**

Statistics	
Total population (2013)	**9,413,000**
Gross national income per capita (PPP international $, 2013)	**16**
Life expectancy at birth m/f (years, 2013)	**70/75**
Probability of dying under five (per 1 000 live births, 0)	not available
Probability of dying between 15 and 60 years m/f (per 1 000 population, 2013)	**167/83**
Total expenditure on health per capita (Intl $, 2013)	**957**
Total expenditure on health as % of GDP (2013)	**5.6**
Latest data available from the Global Health Observatory	

Source: WHO HQ intranet

10. Summary of progress towards regional measles/rubella targets as of 2014 (WUENIC and JRF data). Please add 2015 country data (if available from monthly reporting)



In 2015 (WHO/UNICEF JRF):

Measles – 0 confirmed cases

Rubella – 0 confirmed cases

MCV1 coverage national: 98.1%

MCV2 coverage national: 97.9%

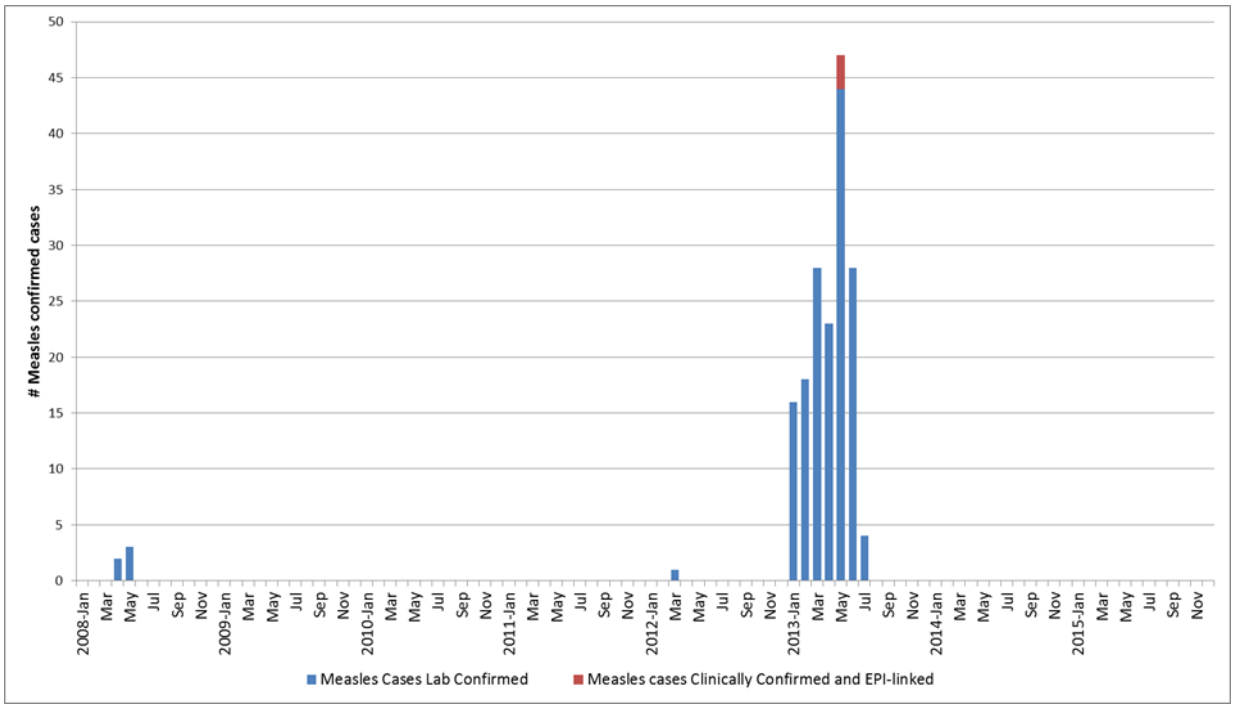
From 4th RVC

Status of measles and rubella elimination in Azerbaijan, in 2014 and for the period 2012–2014

Component	RVC comment
RVC conclusion for 2013	Interrupted endemic transmission of measles and rubella; at risk of re-established transmission of measles.
Epidemiology	Zero confirmed measles, rubella or CRS cases reported. 2013 measles outbreak was stopped.
Surveillance performance	Measles and rubella surveillance sensitivity were inadequate (<2/100 000). Inconsistent denominators were used to calculate measles and rubella discard rates and laboratory testing rate. No CRS surveillance in practice.
Population immunity	Reported MRCV1 and MRCV2 coverage both continue to be >95%. 2nd dose coverage calculation not adequately explained. Approximately 5800 children, in three territories including some rayons of Baku, were not immunized.
Supplementary information	Data provided on supplemental immunization activities (SIAs) and mopping-up conducted in 2014: subnational measles and rubella campaign in October 2014, age group 11-15 years old, target population 171 565, coverage 94%. Annual mop-up among 11-15 years old, 8529 immunized.
Specific comments to	Surveillance sensitivity remains suboptimal and requires improvement.

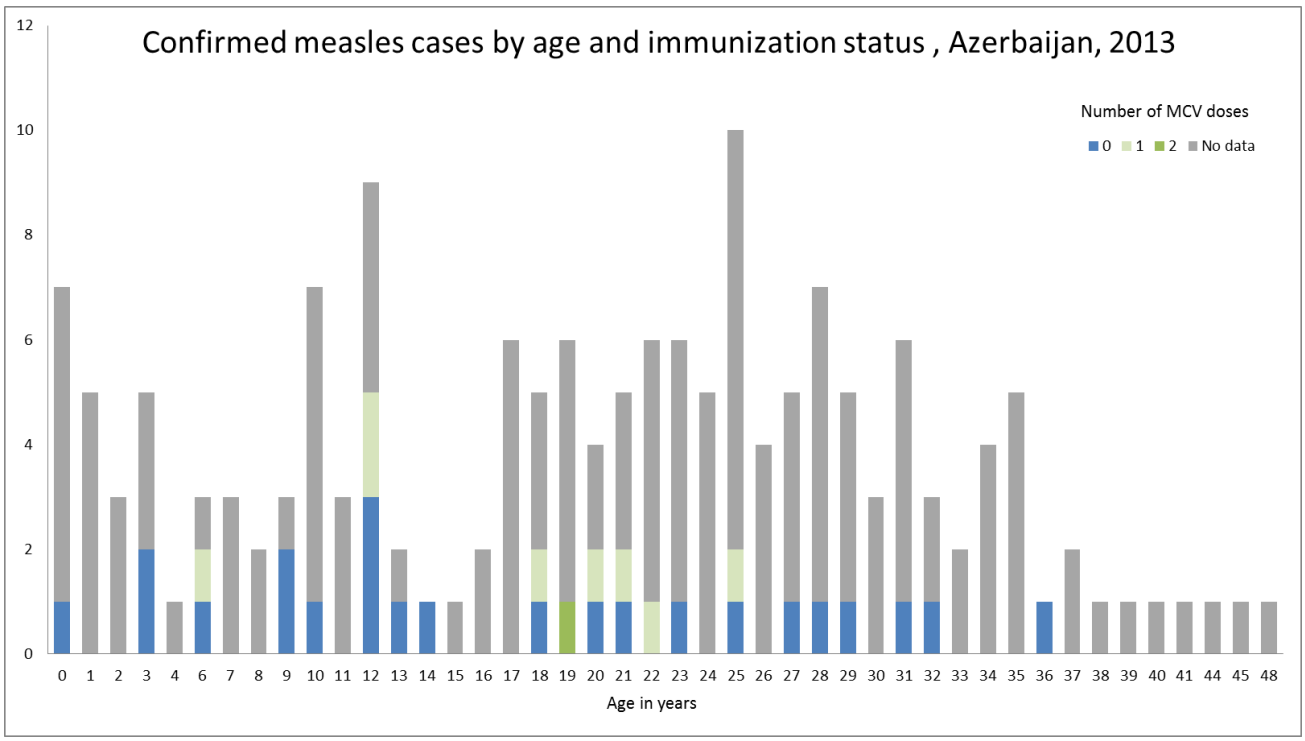
country	Urgent consideration should be given to conducting coverage surveys to establish independent estimates of vaccination coverage. There is evidence for the existence of immunity gaps in some administrative territories, particularly Baku, and steps need to be taken to increase population immunity in these areas.
Conclusion for 2014	**Interrupted endemic transmission of measles and rubella.**
Elimination status for the period 2012–2014	**Measles eliminated.** **Rubella eliminated.**

Distribution of confirmed measles cases by month*, Azerbaijan, 2008-2015



11. Descriptive epidemiology of the most recent measles (or rubella) outbreak
    a. Annual incidence rate (at national level for measles/or rubella) for most recent outbreak year
    b. Age by vaccination status of cases

Available information



In 2013, there was a measles outbreak in the Republic among Baku and Agjabedy district residents. Taking into account insufficient measles and rubella vaccination coverage in districts below, their

population can be considered high risk (MMR-1: Yardymly – 83.8%; Akstafa – 90.5%; Gobustan – 91.8%; Geranboi – 92.4%; MMR-2: Yardymly – 74.6%; Geranboi – 86.9%; Siyazan – 88.2%; Kazakh – 91.8%).

Supplementary mop-up immunization activities were implemented from 28.10 to 05.11.2014 in Baku city, Sumgait, Apsheron and Agjabedy districts using remaining stocks of measles-rubella (MR) vaccine with total coverage of 161,087 people from 14.10-05.11.2014, which represents 94% from the total target group of 171,565 people. Also, mop-up MR immunization of schoolchildren of 11-15 years of age was implemented at the same time in all remaining districts of the country covering 8,529 people in total.

12. What were/are the critical success factors?
    - Country ownership and political commitment
    - Cooperation with international organizations and coordination of partner support
    - Continuous strength of national immunization program
    - Integration of services
13. What were/are the significant barriers to achieving targets?
    - This is a "good" performing country.
    - Main challenge: to keep achievements – assure sustainability
14. Conclusion

Country achieved elimination of MR in period 2012-2014. They can keep it, if they have resources and continuous support (hopefully taking more on their side). They are already taking on additional activities. They initiated strengthening surveillance for CRS, piloting monthly reporting system as part of EIDSS. This will be additional evidence to document absence of rubella.

Portugal

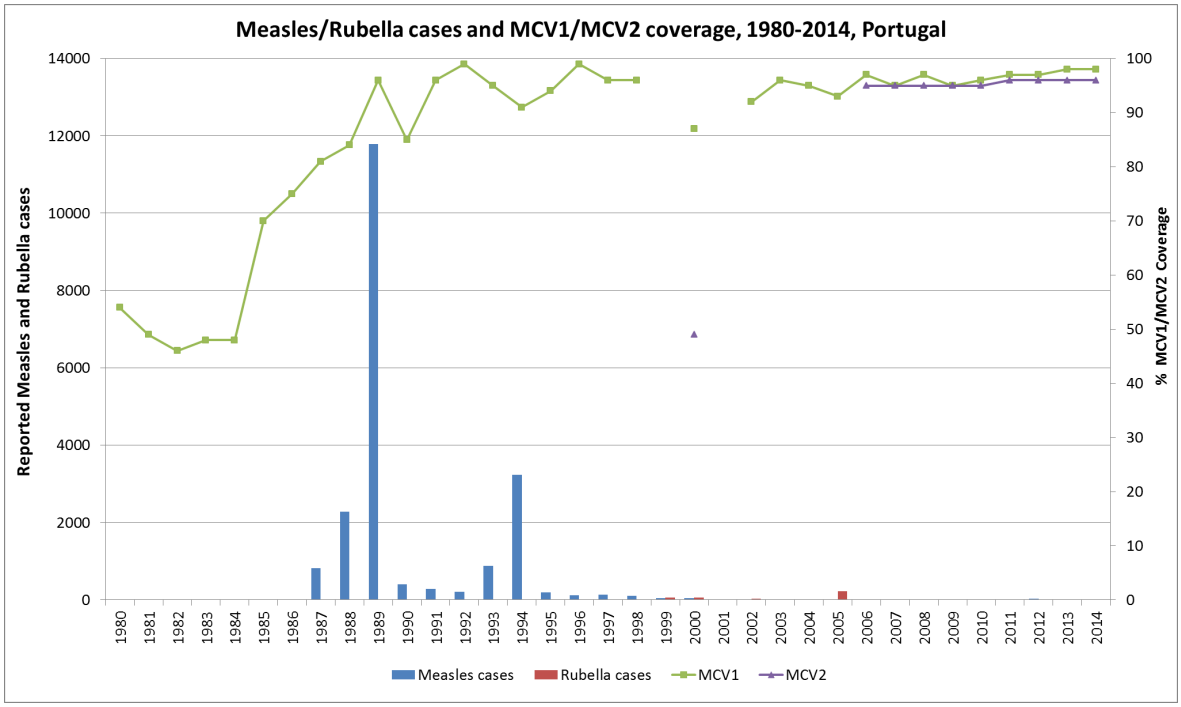
1. Country Name and demographics

Statistics	
Total population (2013)	**10,608,000**
Gross national income per capita (PPP international $, 2013)	**25**
Life expectancy at birth m/f (years, 2013)	**78/84**
Probability of dying under five (per 1 000 live births, 0)	not available
Probability of dying between 15 and 60 years m/f (per 1 000 population, 2013)	**111/48**
Total expenditure on health per capita (Intl $, 2013)	**2,508**
Total expenditure on health as % of GDP (2013)	**9.7**

Latest data available from the Global Health Observatory

Source: WHO HQ intranet

2. Summary of progress towards regional measles/rubella targets as of 2014 (WUENIC and JRF data). Please add 2015 country data (if available from monthly reporting)



From 4th RVC

Status of measles and rubella elimination in Portugal, in 2014 and for the period 2012–2014

Component	RVC comment
RVC conclusion for 2013	Interrupted endemic transmission of measles and rubella.
Epidemiology	Zero measles cases confirmed. Incidence of clinically compatible rubella cases is 0.29 per million population (3 cases). Reported CRS prevalence is 0.096 per million population.
Surveillance performance	Introduction of online notification system SINAVE since 1 June 2014. NVC expects improvement of performance indicators in 2015; recognizes need to improve rubella and CRS surveillance. No genotyping data made available for rubella.
Population immunity	Reported coverage with MRVC1 is 97.8% and with MRCV2 is 95.7%. National assessment of MMR2 coverage by December 2014 reported as >95% in all birth cohorts 1996-2006.
Supplementary information	Universal screening for rubella recommended pre-conception and during 1st and 2nd pregnancy trimesters. Monitoring of immunization coverage and collaboration with schools. Activities on sensitization of parents.
Specific comments to country	RVC commends Portugal on the quality of the 2014 ASU.
Final conclusion for 2014	**Interrupted endemic transmission of measles and rubella.**
Elimination status for the period 2012–2014	**Measles eliminated.** **Rubella eliminated.**

3. Descriptive epidemiology of the most recent measles (or rubella) outbreak
    a. Annual incidence rate (at national level for measles/or rubella) for most recent outbreak year
    b. Age by vaccination status of cases

No significant outbreak since 1994
No data available from 1994.

4. What were/are the critical success factors?
   Public health system in country dedicated and strongly active in regards immunization and regional goals
5. What were/are the significant barriers to achieving targets?
   This is a “good” performing country.
   Main challenge: to keep achievements – assure sustainability

6. Conclusion
   Country achieved elimination of MR in period 2012-2014. They can keep it, if they have resources.

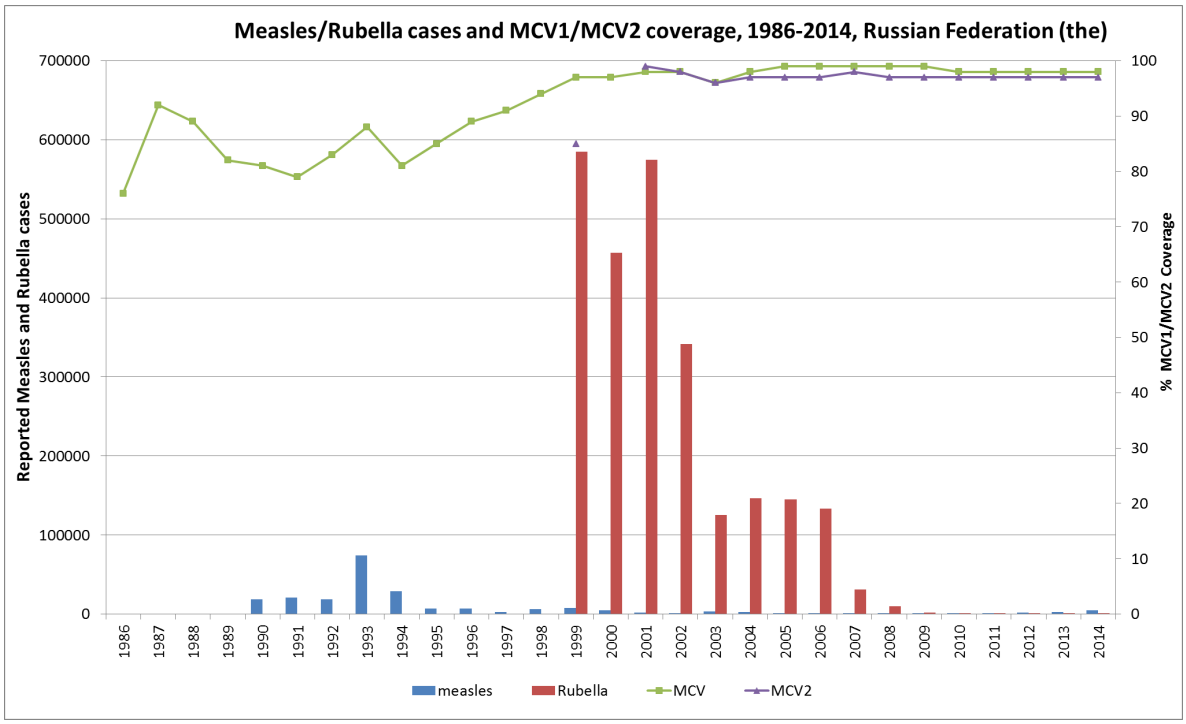
Russian Federation

1. Russian Federation

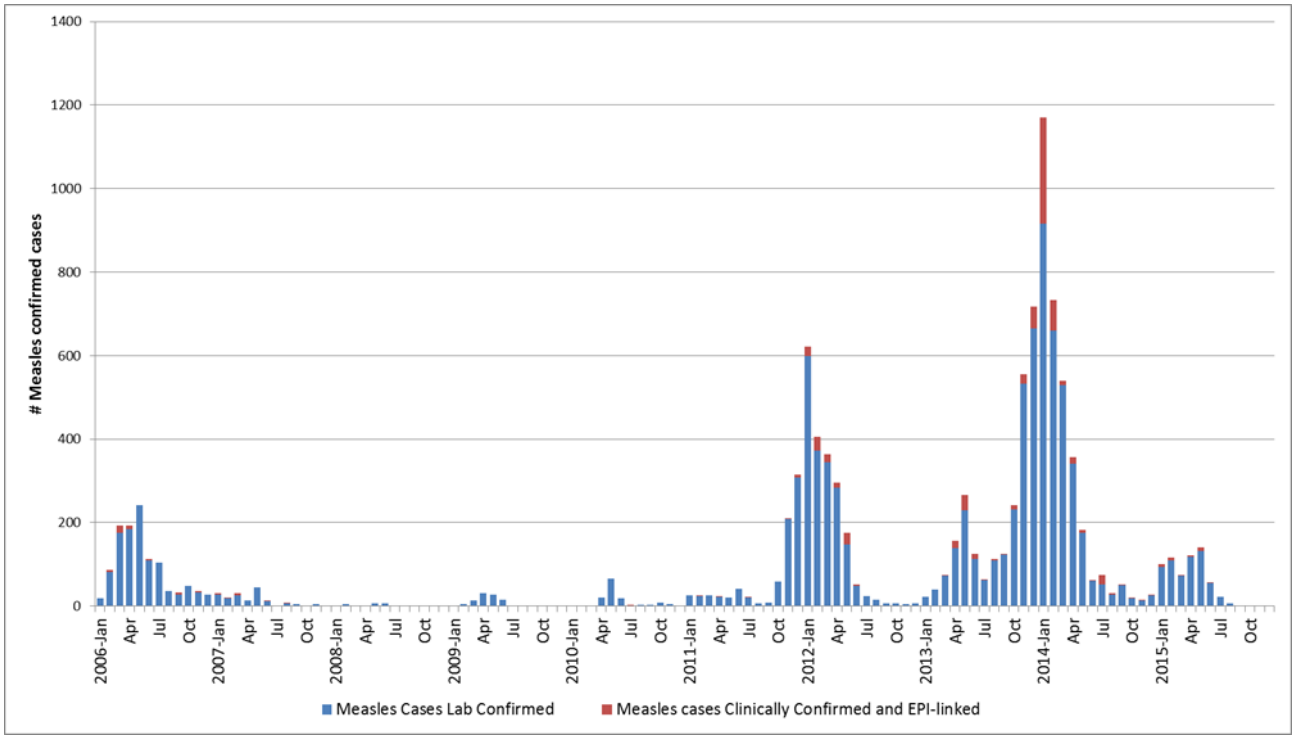
Statistics	
Total population (2013)	142,834,000
Gross national income per capita (PPP international $, 2013)	23
Life expectancy at birth m/f (years, 2013)	63/75
Probability of dying under five (per 1 000 live births, 0)	not available
Probability of dying between 15 and 60 years m/f (per 1 000 population, 2013)	339/126
Total expenditure on health per capita (Intl $, 2013)	1,587
Total expenditure on health as % of GDP (2013)	6.5
Latest data available from the Global Health Observatory	

Source: WHO HQ intranet

2. Summary of progress towards regional measles/rubella targets as of 2014 (WUENIC and JRF data). Please add 2015 country data (if available from monthly reporting)



Distribution of confirmed measles cases by month*, Russian Federation, 2006-2015



In 2015 (WHO/UNICEF JRF):

Measles – 843 confirmed cases

Rubella – 25 confirmed cases

MCV1 coverage national: 97.9%

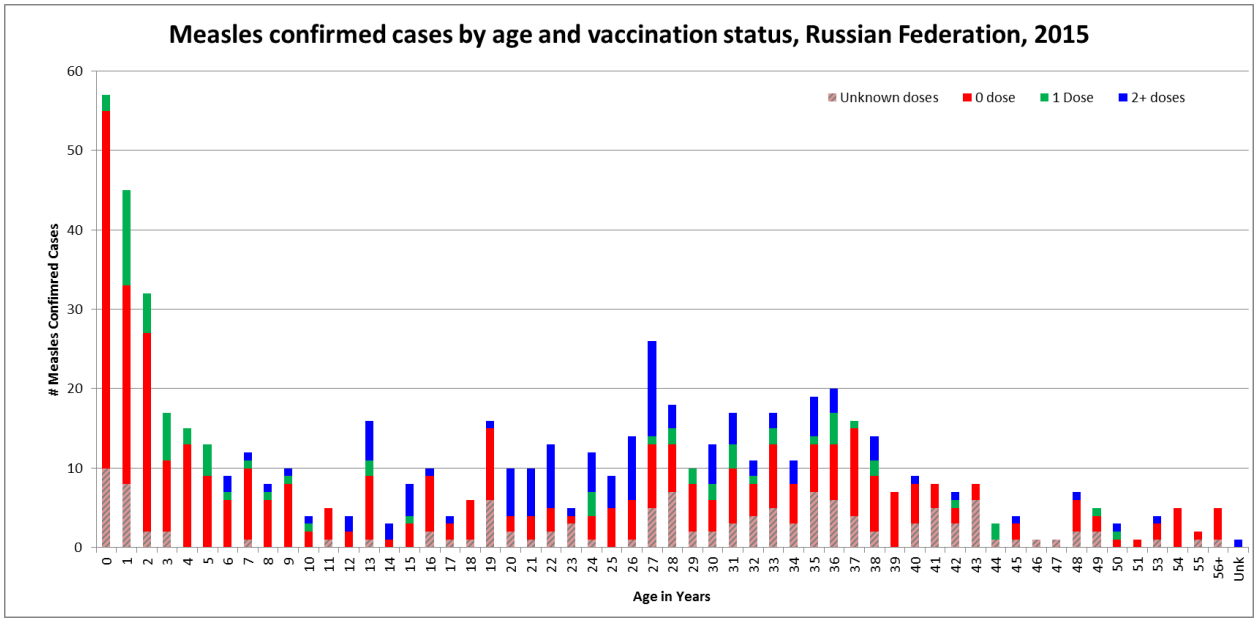
MCV2 coverage national: 97.2%

From 4th RVC

Status of measles and rubella elimination in the Russian Federation, in 2014 and for the period 2012–2014

Component	RVC comment
RVC conclusion for 2013	Endemic transmission of measles; inconclusive for rubella.
Epidemiology	Measles incidence is 32.3 per million population (4711 cases, 55 outbreaks), and has been increasing since 2012. D4, D8 and B3 genotypes detected. Rubella incidence is 0.5 per million population, with 71 of 72 rubella cases classified as endemic. Zero CRS cases reported.
Surveillance performance	Surveillance performance appears to be adequate.
Population immunity	Reported coverage with both MRCV doses is > 95%. Supplementary and mop-up immunization campaigns for adolescents of 15–17 years; immunization of high-risk groups; combined target population 120 394; achieved coverage reported as 94.5%.
Supplementary information	Monitoring of timeliness and completeness of anti-epidemic activities when reporting measles outbreaks.
Specific comments to country	The NVC is commended for responding positively to previous RVC comments and for the quality of the work being undertaken. RVC would appreciate further explanation of the rubella surveillance data.
Final conclusion for 2014	**Endemic transmission of measles and rubella.**
Elimination status for the period 2012–2014	**Measles endemic.** Rubella endemic.

3. Descriptive epidemiology of the most recent measles (or rubella) outbreak
    a. Annual incidence rate (at national level for measles/or rubella) for most recent outbreak year
    b. Age by vaccination status of cases



4. What were/are the critical success factors?
    - Country ownership and political commitment
    - Strong and continuous strength of national immunization program and surveillance
    - Extremely strong laboratory network

    .
5. What were/are the significant barriers to achieving targets?
    - Susceptible population among adults/older adolescents
    - Large population
    - Movement of population (inside RUS and between RUS and other countries previously part of USSR)
    - Possible subnational territories with suboptimal coverage
6. Conclusion
    - The Russian Federation has the resources to achieve elimination of measles and rubella.
    - Given the population and diversity within the country, achieving elimination by 2020 seems unlikely.

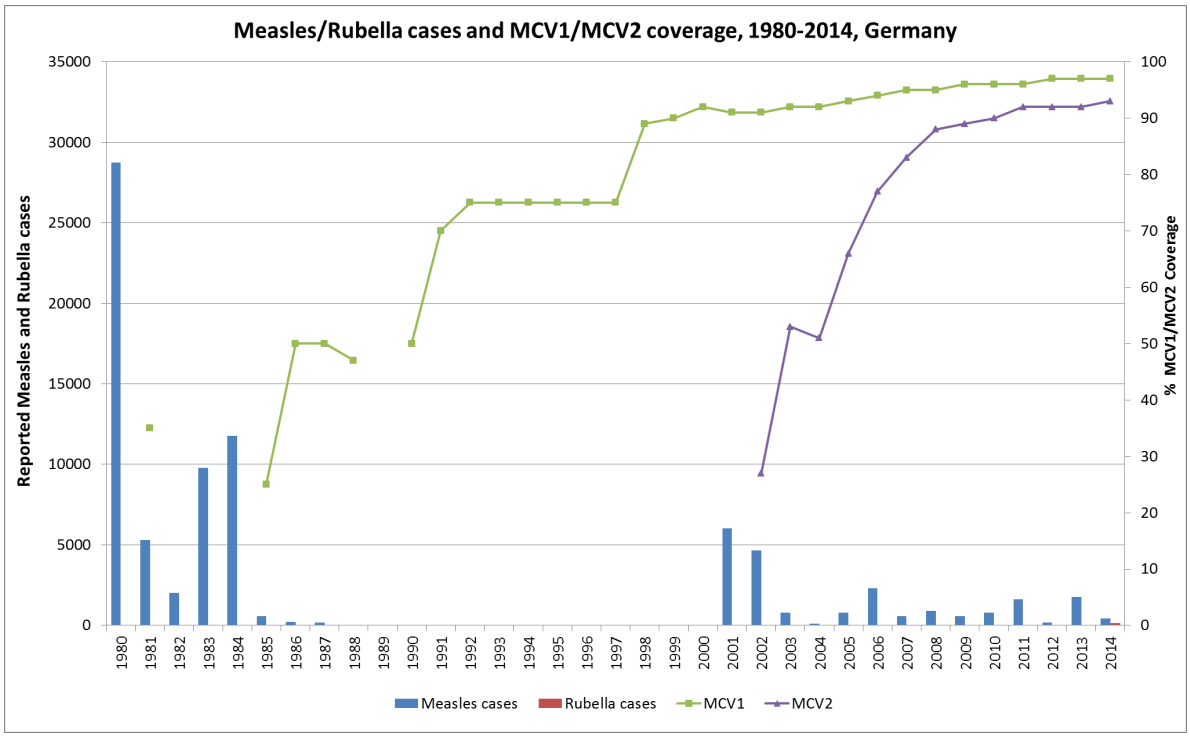
Germany

1. Country Name and demographics **Germany**

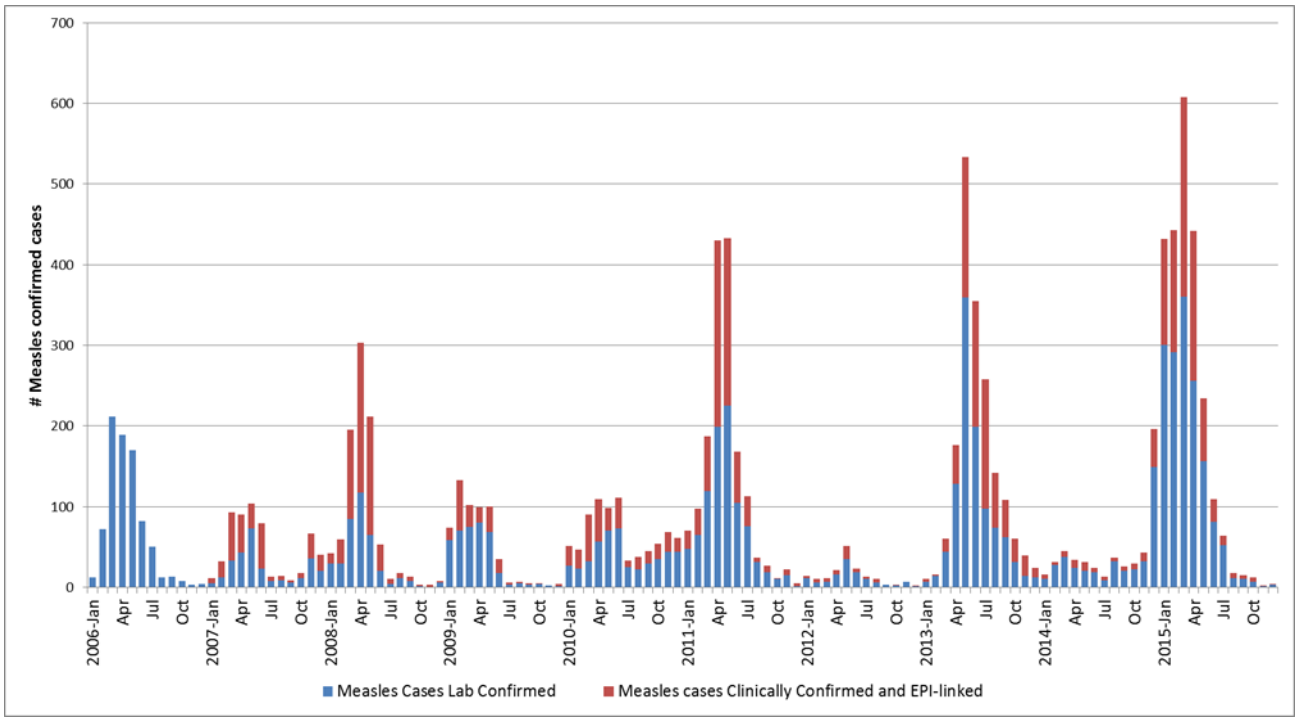
Statistics	
Total population (2013)	**82,727,000**
Gross national income per capita (PPP international $, 2013)	**44**
Life expectancy at birth m/f (years, 2013)	**79/83**
Probability of dying under five (per 1 000 live births, 0)	not available
Probability of dying between 15 and 60 years m/f (per 1 000 population, 2013)	**92/50**
Total expenditure on health per capita (Intl $, 2013)	**4,812**
Total expenditure on health as % of GDP (2013)	**11.3**
Latest data available from the Global Health Observatory	

Source: WHO HQ intranet

2. Summary of progress towards regional measles/rubella targets as of 2014 (WUENIC and JRF data). Please add 2015 country data (if available from monthly reporting)



Distribution of confirmed measles cases by month*, Germany, 2006-2015



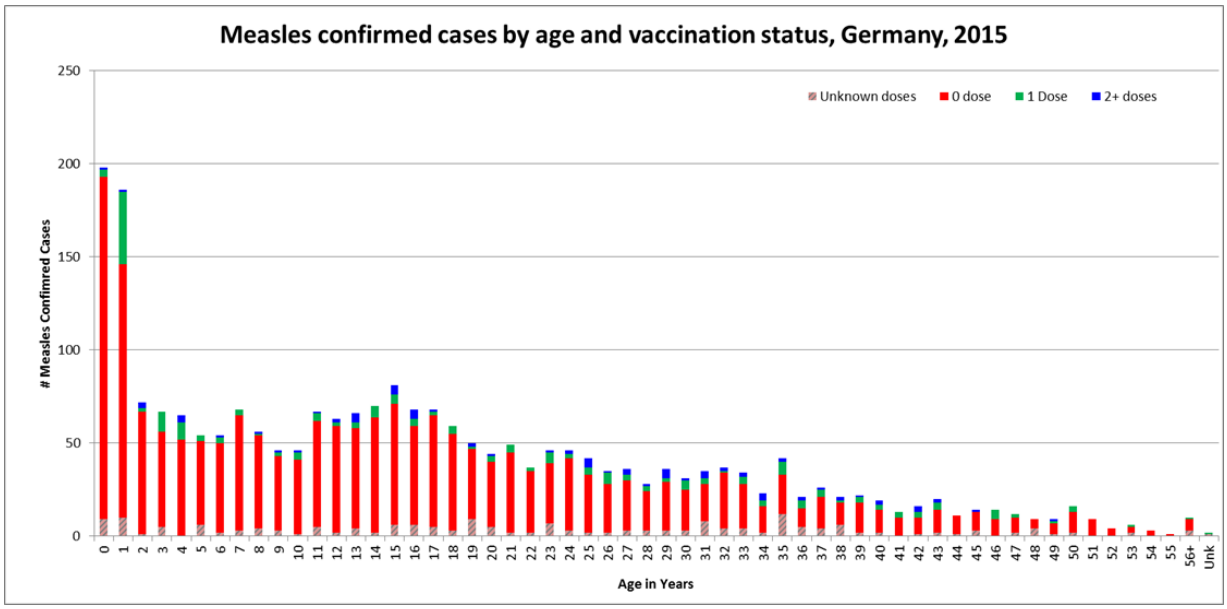
In 2015 (WHO/UNICEF JRF):
Measles –2464 confirmed cases
Rubella – 90 confirmed cases
MCV1 coverage national: 96.8%
MCV2 coverage national: 92.8%

From 4th RVC

Status of measles and rubella elimination in Germany, in 2014 and for the period 2012–2014

Component	RVC comment
RVC conclusion for 2013	Endemic transmission of measles and rubella.
Epidemiology	Measles incidence of 4.9 per million population. 443 cases reported with 40 outbreaks (17 genotyped); B3, D8, genotypes detected. Rubella incidence of 1.8 per million population. 151 cases reported with 2 outbreaks; no genotype data. Zero CRS cases reported.
Surveillance performance	Number of suspected cases of measles and rubella not available. Rate of discarded cases not available. Rate of viral detection : 55% measles, 0% rubella Most of reported rubella cases only clinically compatible. Sensitivity of surveillance not yet high.
Population immunity	Coverage data for 2014 not yet available. Cohort generated from country-wide health insurance claims data: At 24 months MRCV1 coverage is 94.9%, MRCV2 is 70.1%. At 36 months MRCV1coverage is 97.6%, MRCV2 is 84.8%. At 48 months MRCV1 coverage is 98.1%, MRCV2 is 87.8%. 4 territories identified with low coverage for MRCV2. Among refugees 87% seropositive. Anthroposophical communities identified with 58.2% coverage.
Supplementary information	Outbreak reports provided as an additional document. Several activities established (e.g. laboratory sentinel to assess discarded cases of measles, implementation of a national outbreak reporting form, national working group to develop a National Action Plan for the Elimination of Measles and Rubella (2015–2020), national conference on MR elimination).
Specific comments to country	The quality of measles and rubella surveillance still needs to be clarified. Efforts should be made to have ≥ 80% of specimens tested in WHO-accredited laboratories or laboratories with known high proficiency.
Conclusion for 2014	**Endemic transmission of measles and rubella.**
Elimination status for the period 2012–2014	**Measles endemic.** **Rubella endemic.**

3. Descriptive epidemiology of the most recent measles (or rubella) outbreak
    a. Annual incidence rate (at national level for measles/or rubella) for most recent outbreak year
    b. Age by vaccination status of cases



4. What were/are the critical success factors?
    - Strong country ownership, adequate financing and high level political commitment
    - Strengthening of surveillance and laboratory capacities

5. What were/are the significant barriers to achieving targets?
    - Federal decentralised structure, process to make changes and introduce new things at national and subnational level takes time
    - Large population, and susceptible among adults/adolescents
    - GER is country which is target for immigration for people from many European and out of Europe countries

6. Conclusion

    - GER has the resources to achieve elimination of measles and rubella
    - Its governmental structure makes it difficult to carry out activities throughout the nation in synchronous fashion

The recent influx of large numbers of immigrants makes achieving elimination targets by 2020 difficult.

5 SEAR Regional Status

5.1 Regional control and/or elimination targets[10]

a. Measles targets: 2020
b. Rubella target: Control of rubella/CRS by 2020

Comment:

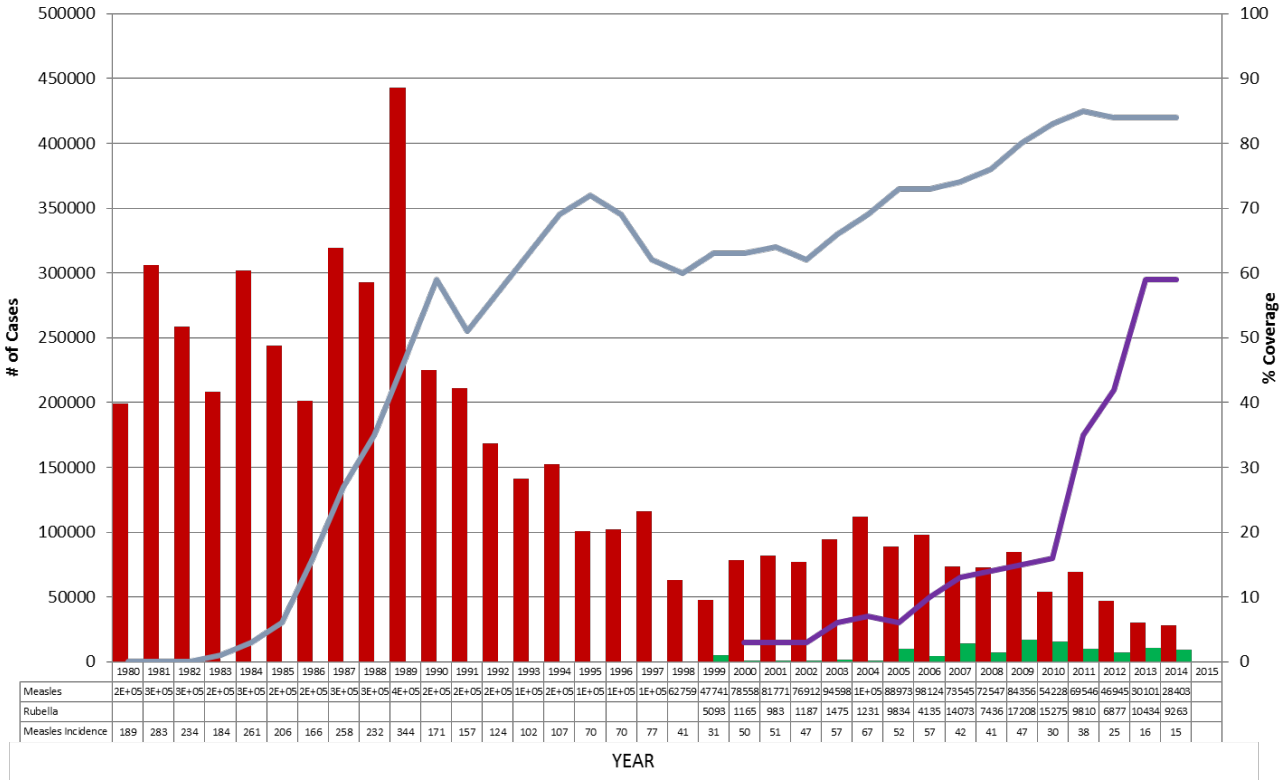
Last case of indigenous polio was reported in 2011, Regional polio certification achieved in 2014

5.2 Summary of progress towards regional targets (Table 1)

- In September 2013, following an extensive review of progress made and the biological, programmatic and financial feasibility, the 6th session of the Regional Committee of the South-East Asia Region (SEA/RC66/R5), adopted the goal of measles elimination and rubella/CRS control in the South-East Asia Region by 2020.
- Significant progress has been made towards meeting the GVAP milestones for 2015 with 66% reduction in mortality due to measles from 2000 to 2014. However, MCV1 coverage has stagnated at 84% since 2012. The MCV-1 coverage by country from 2010 to 2014 shows that at least 6 countries did meet the GVAP goal of ≥90% MCV-1 coverage at national level. With the introduction of MCV-2 in all of India in 2014, regional coverage is estimated at 60%.

[10] Resolution SEA/RC66/R5, September 2013

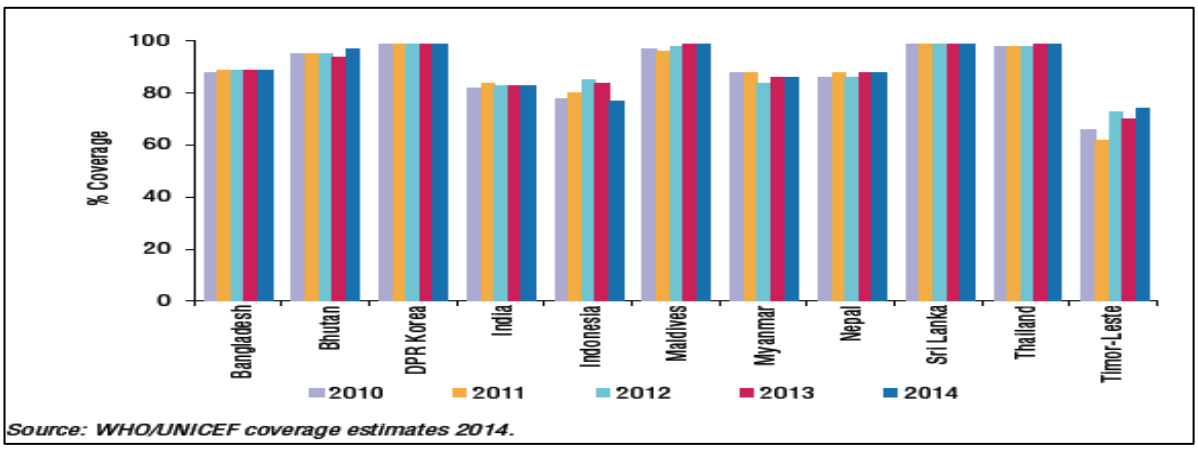
Southeast Asian Region Measles and Rubella, 1980-2015



	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Measles	2E+05	3E+05	3E+05	2E+05	3E+05	2E+05	2E+05	3E+05	3E+05	4E+05	2E+05	2E+05	2E+05	1E+05	2E+05	1E+05	1E+05	1E+05	62759	47741	78558	81771	76912	94598	1E+05	88973	98124	73545	72547	84356	54228	69546	46945	30101	28403	
Rubella																				5093	1165	983	1187	1475	1231	9834	4135	14073	7436	17208	15275	9810	6877	10434	9263	
Measles Incidence	189	283	234	184	261	206	166	258	232	344	171	157	124	102	107	70	70	77	41	31	50	51	47	57	67	52	57	42	41	47	30	38	25	16	15	

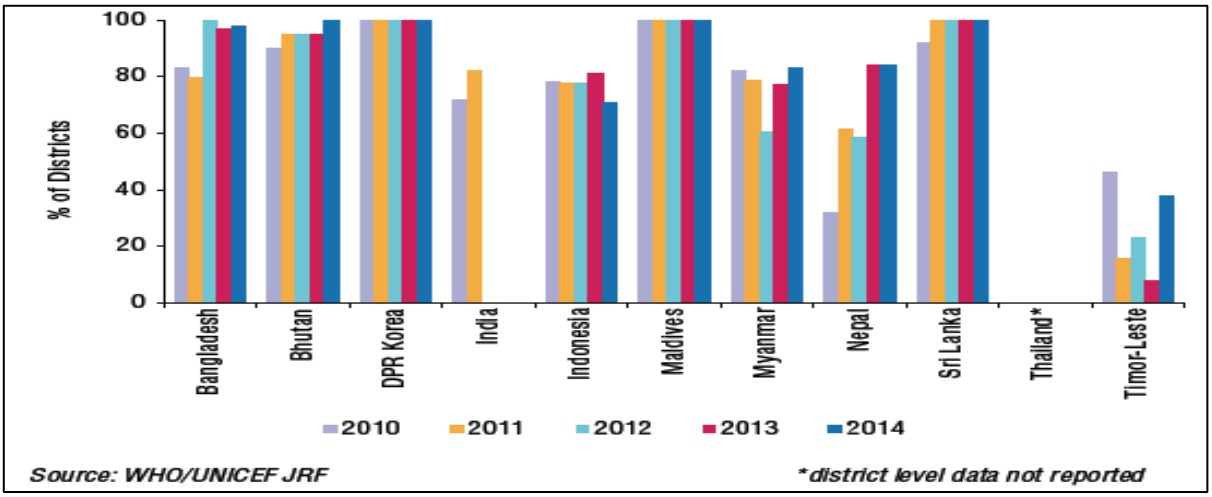
Data Source: Measles/Rubella cases from JRF, 2015 data provisional
MCV1/MCV2 data are WUENIC estimates, except 2015 data provisional official estimate
Measles Incidence is per million: denominator is the UN population estimate.

MCV1 Reported Vaccination Coverage by Country in the SEAR, 2010-2014



Except for Indonesia, India, Timor-Leste, all countries report over 80% of district with MCV1 coverage > 80% in 2014. District level data in Thailand is not reported.

Proportion of Districts with Reported MCV1 Coverage >80% by Country in the SEAR, 2010-2014



5.3 Summary on progress towards regional targets

Summary of Progress towards Regional Targets

Indicator	Regional Status in 2014	Comment
7. No. (%) of countries with MCV1 ≥90% nationally and >80% in all districts.	• 5/11 countries with MCV1 ≥90% nationally • 4/10 countries with MCV1 >80% in all districts nationally	• WUNIC data as of July 2015 (Bhutan, DPRK, Maldives, Sri Lanka & Thailand) • AERF 2014 (Bhutan, DPRK, Maldives, Sri Lanka), sub-national data not available for Thailand
8. No. (%) of countries with MCV2 >90% nationally and >80% in all districts.	9. 5/9 countries with MCV2 >90% nationally 10. 3/8 countries with MCV2 >80% in all districts nationally	• WUNIC data as of July 2015 (Bhutan, DPRK, Maldives, Sri Lanka &Thailand); MCV2 introduced only in 9 countries • AERF 2014 (DPRK, Maldives, Sri Lanka), sub-national data not available for Thailand
7. No. (%) of countries with RCV in routine	• 6/11 countries with RCV in routine	
8. No. (%) of countries conducting SIAs with >95% in every district.	• None out of five countries (2012-2014)	During 2012-2014, SIAs done in Bangladesh, India, Myanmar, Nepal and Sri Lanka.
9. No. (%) of countries with measles incidence less than five cases per million populations.	• 7/11 countries with measles incidence less than five cases per million population.	Bangladesh, Bhutan, DPR Korea, Indonesia Maldives, Myanmar, Thailand. These should be viewed in conjunction with the surveillance performance.
10. No. (%) of estimated measles deaths, the percentage reduction since 2000, and number of deaths averted through	• Estimated measles deaths 46,900 (95% CI 27,900-80,800) • 66% mortality reduction from 2000 to	

vaccination.	2014	
15. No. (%) of estimated CRS cases, the percentage reduction since 2000, and number of cases averted through vaccination	• Estimated 46,621 CRS cases (95%CI 1,016 to 168,910); • (Reported 26 CRS cases in 2002,and 86 in 2014	
16. No. (%) of priority countries providing ≥ 50% op costs for SIAs	• 2/5- India and Sri-Lanka	Priority countries in SEAR- Bangladesh, India, Indonesia, Myanmar, Nepal and Timor-Leste
13. No. (%) of MCV SIAs that include additional child health interventions	• 4/5 – except Sri Lanka had OPV	
18. No. (%) of countries conducting routine immunization and AEFI training as part of SIA training	• All	
19. No. (%) of priority countries holding a MR surveillance review between 2012-2015	• Internal- All • External- None	

a) Brief comment on table showing progress

With countries like India and Indonesia that have large birth cohorts, and are yet to implement nationwide measles-rubella campaign to close the immunity gap, the regional progress seems to be skewed towards slow progress made by these two countries.

5.4 Summary of implementation of each of the 5 key strategies

f) Achieve and maintain high levels of population immunity with two doses of measles and rubella containing vaccines;

All countries in the region have introduced two dose of Measles containing vaccine in routine immunization schedule but DPR Korea, India, and Indonesia are yet to introduce Rubella containing vaccine in routine immunization.

g) Monitor disease using effective surveillance

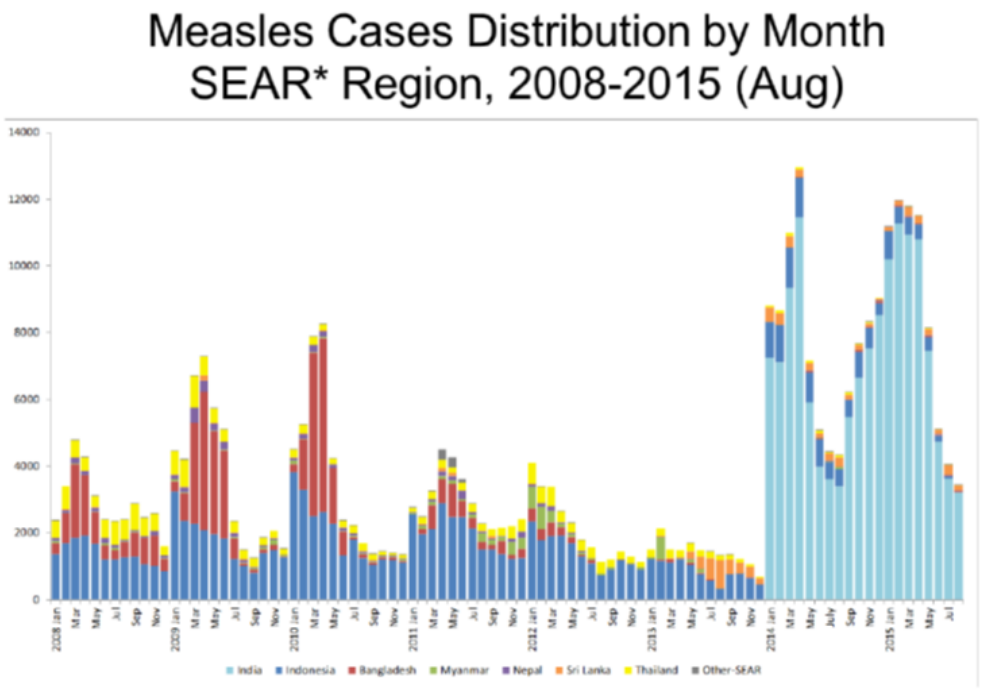


Table 2: Measles and rubella surveillance indicators

Indicator	2012	2013	2014	Remarks
Discarded non-measles rate[1]	1.88	1.96	2.05	
% second level units with ≥ 2 discarded cases[1]	15.51%	15.76%	16.01%	No data from Bhutan, India, Indonesia and Sri Lanka - *excluded from denominator*
% suspected cases with adequate investigation	65%	67%	70%	No data from India, Indonesia, Myanmar, Nepal and Sri Lanka - *excluded from denominator*
% suspected cases with adequate blood specimens	ND	ND	ND	Not reported to SEAR
% serology lab results ≤ 4 days of receipt	51%	72%	67%	No data available from Thailand, and data from Myanmar available only for 2014 - *excluded from denominator when data not available.*
% serology lab results ≤ 7 days of receipt				

[1] Per 100 000 population

All countries in the region perform laboratory supported case-based surveillance for all sporadic cases except for India and Indonesia where cases-based surveillance is limited to outbreaks and to some selected sub-national units only. Until these two countries complete wide-age ranged MR campaign nation-wide, the existing laboratory network will not be able to support case-based surveillance.

The surveillance system needs to be enhanced to capture most cases from the community. Currently approximately 73,831 suspected cases of measles have been reported in the region in 2014 while the MSP tool estimates for the same year is about 1.6 million cases of measles which points to the fact that much is needed to be done in terms of surveillance of measles like cases.

In 2003, a measles laboratory network has been established in the Region. Bangladesh, Bhutan, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka, and Thailand have national measles laboratories linked to epidemiological surveillance (except Sri Lanka). By 2014, the SEAR Measles and Rubella Laboratory Network has expanded to include 39 proficient laboratories with one Regional Reference Laboratory (RRL) in Thailand. All countries except Timor Leste had at least one proficient laboratory. India had total of 9 proficient laboratories, Indonesia 4, and Thailand 13. The Regional Measles and Rubella Laboratory Network tested 3,288 serum specimens from suspected measles cases in 2005, and 21,829 serum specimens in 2014, with 90% of results available within 7 days of receipt.

h) Develop and maintain outbreak preparedness, respond rapidly to outbreaks and manage cases;

All countries in the region have developed outbreak response plans and are prepared to response to outbreak. However, regional guidelines have been developed for accelerated control and not for elimination phase response to outbreak where every single case should be labelled as outbreak.

i) Communicate and engage to build public confidence and demand;

All countries in the region have developed a risk –communication plan for AEFI based on lessons learnt from the introduction of new vaccines.

j) Research and development to support cost-effective operations and improve vaccination and diagnostic tools.

The region is unaware of activities related to this topic.

2. Successes and failures in applying the 4 basic principles

b) Country ownership & sustainability

Measles elimination has national government commitment from all the eleven countries and in 2013, the Regional Committee resolved to eliminate measles by 2020. Countries have developed national plans to accommodate this commitment which shows high level of country ownership to achieve this goal. However only 2 countries, India and Sri Lanka are financing > 50% of SIAs operational costs.

e) Routine immunization and health system strengthening

Measles elimination is not seen as an isolated program in the region and the regional strategy has been to achieve high population immunity through strengthening routine immunization and the realization of the fact that the program cannot depend on repeated SIAs like the Polio program.

Measles elimination is also expected to contribute to immunization system strengthening in the region.

f) Equity

Countries in the region see immunization as Public Good and at least two countries (Nepal and Sri Lanka) have even developed National Immunization Act to ensure this as basic rights of the population in the country. Reaching the unreached population is the key to closing the immunity gap and achieving equity in terms of immunization service delivery. Reach every child strategy has been adopted in all countries in the region.

g) Linkages

The current measles surveillance builds on the existing AFP surveillance program and depends on the approaches used and identified by the Polio program to reach the unreached population and conduct high quality SIAs.

5.5 Success factors enabling progress

6. MCV1 & MCV2 coverage increase gradually in India.
7. Rubella vaccine, provided supply is available, will be introduced gradually in India in 2016-2018
8. India started reporting measles case base data.
9. Laboratory network of 37 laboratories with at least one national measles-rubella laboratory (NML) in each of the 11 countries with capacity for virus isolation and genetic sequencing.
10. Strong immunization system in Sri Lanka, no reported indigenous measles transmission in Bhutan, DPR Korea and Maldives for over 3 years.
11. Good regional documentation measles activities through country factsheets and surveillance bulletins.

5.6 Barriers to achieving the targets

9. Challenges to achieve measles elimination exist in SEAR. In 2014, routine MCV coverage was suboptimal and of the estimated 21.5 million infants not receiving MCV1 globally, approximately 6.4 million (30%) were in India and 0.7 million (3%) in Indonesia. For the last 5 years, in Timor Leste, MCV1 coverage has never exceeded 74%. In addition, more than half of the SIAs implemented in SEAR during 2003–2014 did not achieve the target of ≥95% coverage. Most of the countries in the region have not achieved 95% coverage for MCV-1 and MCV-2 at both national and Sub-national level. There is no bigger challenge than achieving this level of coverage. Two countries, Nepal and Timor Leste have not yet introduced MCV2.
10. The supply for MR vaccine in the region is high if the two large countries India and Indonesia plan to do Nation-wide SIA and continue to use MR in routine immunization. Currently

there is only one WHO pre-qualified MR vaccine manufacturer in the region, this would require a significant lead time to manufacture such amount of vaccine and will push timelines for progress.

11. Only 2 (India, Ski Lanka) of the 5 countries needing to organize SIA are providing over 50% of operational costs.
12. Gaps in surveillance: no surveillance network in Timor Leste, weak surveillance network in Bangladesh, India, Myanmar and Nepal, and no linkage between case based and laboratory surveillance in Sri Lanka.
13. Not all measles cases are brought to the health systems due to socio-cultural barrier as well as lack of health system network to capture these cases. Thus enhancing surveillance is key.
14. Develop/improve guidelines to reduce nosocomial transmission of measles.
15. Regional verification commission for measles elimination not yet established.

5.7 Conclusion

If accelerated progress can be made in India and Indonesia and if these two countries close the immunity gap for measles by 2018, the region has high possibility to achieve the regional goal to eliminate measles by 2020. However aggressive and innovative approaches to improve particularly routine immunization systems are required including a reactive case-base surveillance system.

With 35 million surviving infants in the Region (26% of the total global total), measles elimination in the SEAR represents a significant opportunity to decrease measles-related death and illness globally by 2020.

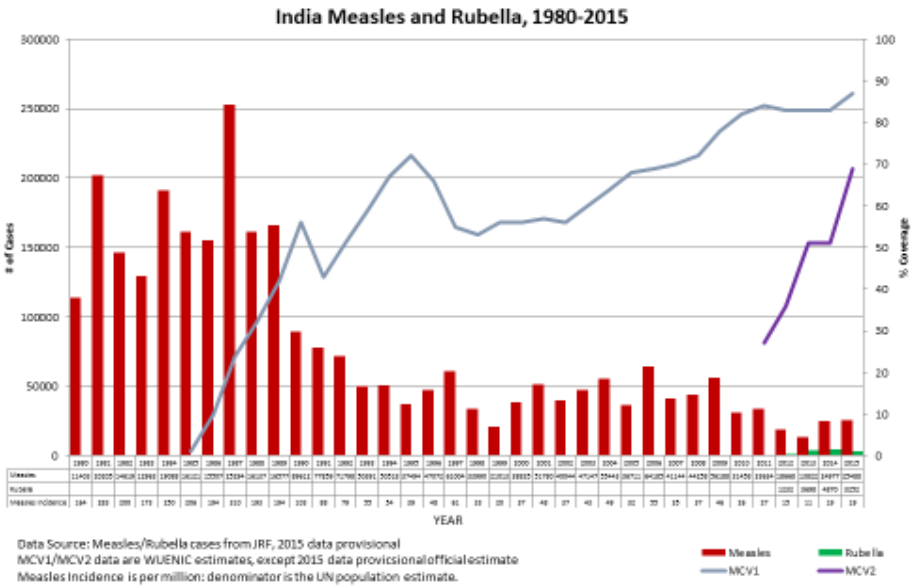
5.8 Country Case Studies

India

15. Demographics

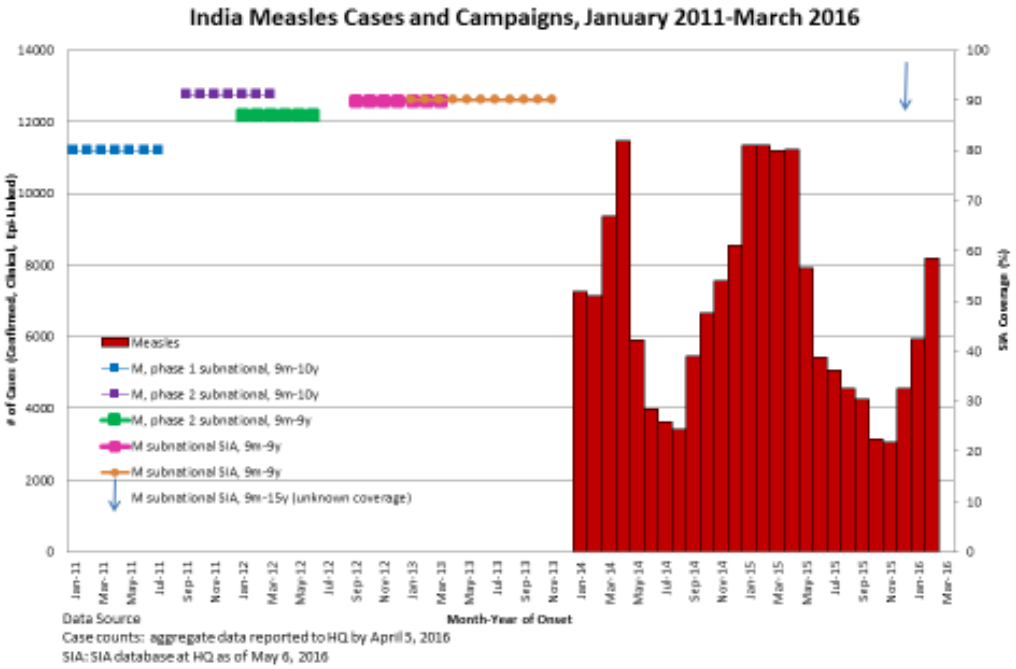
With a population of 1.2 billion, India is the largest among the 11 SEAR countries with ~ 27 million annual birth cohorts, which is again the largest birth-cohort in the world. India has 36 different states and union territories, governed independently having varied socio demographic profiles. States are integrated under the national health mission (NHM) for implementing national programs including UIP (universal immunization program) that has been the overarching umbrella for immunization in all the states since 1985. The country's target population for conducting proposed MR campaign is ~ 400 million (9 months < 15 Years).

16. Summary of progress towards regional measles/rubella targets as of 2014



- National MCV1 coverage is ~ 83 % (as per WHO-UNICEF joint estimates, JRF-2014). UNICEF & WCD (Women and Child Development department) have conducted RSOC (Rapid Survey of Children) that puts evaluated coverage of India at ~79%.
- By 2014, MCV2 was in the routine immunization program in all 36 States and Union Territories.
- By 2014 a measles/rubella laboratory supported surveillance was established in 34 out of 36 States covering ~99% of country population.
- MR surveillance system is integrated with the polio surveillance network supported by WHO-India, NPSP as one of its transitioning.
- Efforts have been initiated by the union government to explore establishing sentinel-site surveillance for CRS (Congenital Rubella Syndrome) that can be piloted in some selected centres in coordination with ICMR (Indian Council of Medical Research).

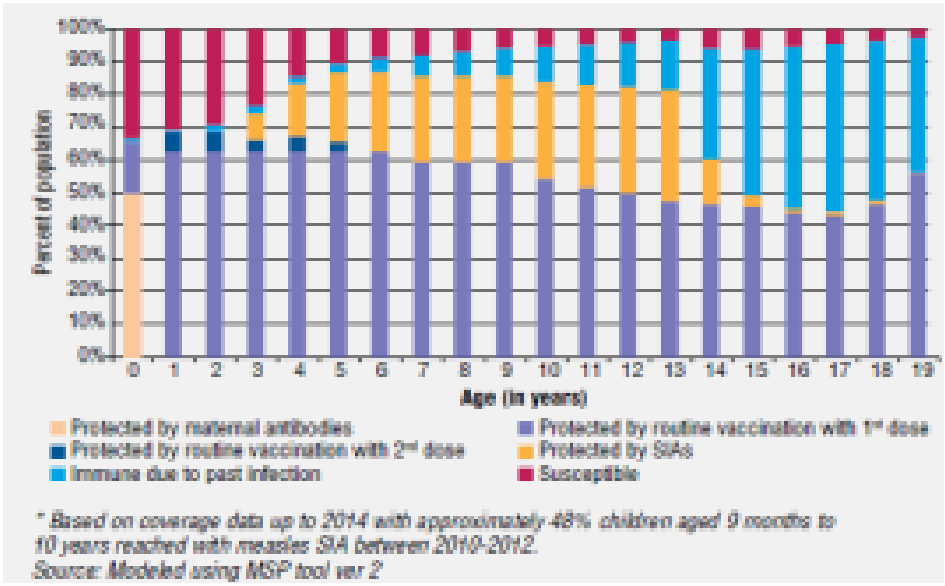
- Wide age range measles catch-up campaigns were completed in 14 high burden states, targeting ~ 130 million children with an administrative coverage of ~ 91%, whereas post campaign, survey results from selected states shows measles SIA coverage to be ~ 70%.



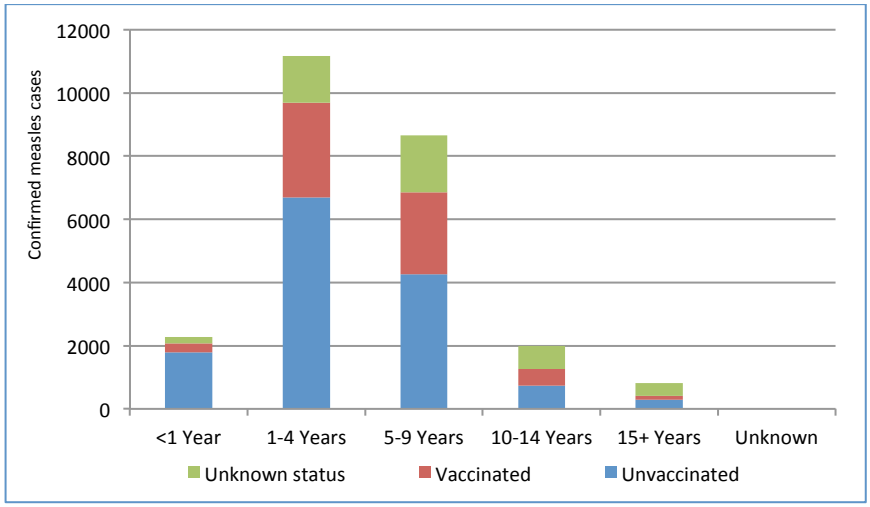
17. Five key strategies

a. *Has the country achieved and maintained high population immunity through vaccination with 2 doses of M/MR/MMR vaccine?*

Immunity profile by Age in 2015, India



Age Distribution of Confirmed Measles cases, India (N= 24,909)



Not yet; MCV1 coverage is 83% (WHO-UNICEF JRF data) but MCV2 is < 80% (HMIS). These figures match the measles case age distribution where most of the cases and susceptible are below 5 years. In addition MCV2 was also provided though wide age range phased campaigns in 14 high burden states spanning from 2010-2013 as a second opportunity. This catch-up campaigns, targeted children (9 months-<10 Years) and vaccinated ~119 million children (administrative coverage of ~91%). Post campaign coverage surveys in selected states had figures at ~ 70% with urban areas lower than the rural one's due to challenges of urban health infrastructure.

b. Has the country developed an effective disease surveillance system supported by a WHO accredited laboratory?

Yes; the country has developed and established an effective disease surveillance system supported by 14 WHO accredited Measles-Rubella laboratory network covering all the states across India. This system has been established and integrated in the AFP surveillance platform, assisted by WHO-India NPSP.

c. Has the country been successful in conducting outbreak preparedness and response?

Yes; the already established Laboratory supported outbreak based MR surveillance system across the country is integrated with an outbreak response on the ground and case management including Vita-A administration. The current outbreak investigation, as a priority aims to reduce measles mortality by preventing post-measles complications. As a standard protocol house to house search of all suspected cases are undertaken and Vitamin-A, ORS, Antibiotics and referral services are provide but without immunization response. In the year 2014, under the MR surveillance system, 1,026 suspected outbreaks were investigated across the country using standard outbreak investigation protocols. 772 outbreaks were lab-confirmed as measles and 113 were lab-confirmed as rubella and 17 outbreaks were classified as mixed outbreaks.

d. *Has the country developed communication strategies to build public confidence in vaccination?*

Yes, communication strategies have been developed and incorporated in the Multi Year Strategic plan and being implemented by both the national and state governments. There has been a lot of impetus on the recent Mission Indradhanus program launched in 2014 as a national flagship campaign across the country to improve immunization coverage. The approach is aimed at reducing both left outs and drop outs through routine immunization micro plans and thus enhancing the full immunization coverage in the country. Monitoring data suggests the lack of effective social mobilization as the principal reasons for non-vaccination, both during routine immunization and measles catch up campaigns.

e. *Has the country implemented innovative strategies or conducted operational research to access previously unreached communities with vaccination services and/or disease surveillance capability?*

Yes;

- Post campaign coverage evaluation surveys were conducted in three states following the measles catch-up campaigns, to estimate campaign coverage and find reasons analysis for non-vaccination and effective communication for the community.
- Through the recently implemented Mission Indradhanus, synchronised immunization weeks for identifying and vaccinating with all routine vaccines unreached areas or population were organized.

18. **What were the critical success factors?**

- The Universal immunization program is a national program since 1985 and integrates the whole country as a federal structure when it comes to UIP. Under UIP, the national government has a centralized procurement system, delivering vaccine and logistics across to all the states and union territories, whereas the state governments are responsible for vaccination of children as per the national immunization schedule. This demonstrates the coordination and government ownership at both national and state levels across India.
- Partners like WHO and UNICEF work together in coordination with the (central) and state governments, as demonstrated though the successful elimination of polio from the country.
- WHO-India NPSP (National Polio Surveillance Project) has a field network of>300 surveillance including ~1000 field monitors and UNICEF has ~7000 community mobilizers placed in the high burden states across India. All these experienced polio manpower are being engaged to support routine immunization strengthening and measles elimination across the country.

- Measles elimination and rubella/CRS control program in the county is supported by WHO-India, NPSP, that has been providing strategic technical assistance to the governments at every level in all strategic components, including M/R surveillance, MCV campaigns, MCV coverage in routine immunization (through routine immunization monitoring and feedback).
- There is an established NTAGI, which is the national technical advisory group on immunization, that reviews and recommends strategies for new vaccine introduction based on which the MOH&FW takes policy decisions at the national level on UIP.
- In line with the Polio eradication program Government of India has also established IEAG-MR (India Expert Advisory Group for Measles and Rubella), including experts from both national and international level. This IEAG-MR is expected to be convened periodically for reviewing county strategies on measles elimination and rubella/CRS control goal by 2020 and to provide expert advice including recommendations for policy decision making and strategies for implementation, in order to reach country's elimination goal.
- As required Government of India also has formed a national verification committee in line with the polio certification committee to review progress on measles elimination and rubella /CRS control goals in the country.
- Traditionally GOI pays for all vaccines costs as well as most operational costs for UIP from the domestic funds including the first measles catch up campaigns and also plans to finance operational costs for follow up campaigns with MRCV, but has applied for GAVI support for rubella vaccine introduction in the country.

19. **What were the significant barriers to achieving targets?**
    - Delay in ensuring financial support from GAVI, for the wide age-range MRCV campaigns.
    - Country's MCV1 and MCV2 coverage in routine immunization are sub-optimal at present, than the required ~ 95% in an elimination setting.
    - Sentinel site CRS Surveillance is not existing in the country, hence it will be difficult to measure true CRS burden pre and post RCV introduction.
    - Case based MR surveillance in all the states across the country will be an essential requirement for the country. At the same time, with the current burden of~ 60,000 suspected cases of measles /year, case based surveillance may be expensive. Challenges like (DTP-B not equal to MCV2; urban coverage lower than rural coverage for campaign and routine) that would be best addressed with preliminary investigation and operational research for which there are currently limited resources.

20. Conclusion

a. *What can be achieved by 2020 with current projected resources*

- Based on financial and vaccine support, India plans to complete the wide age range MRCV campaign followed by introduction of MRCV in the national immunization program in all the states.
- India plans to establish a case based surveillance system for both measles and rubella across all the states, giving true disease incidences in the country.
- India will have established sentinel site CRS surveillance across all the states.

b. *What additional activities, strategies/tactics, and resources are needed to achieve, or maintain*, the regional targets

- India needs to have an enhanced routine immunization platform to deliver MRCV coverage of > 95% (for both MRCV1 and MRCV2)
- India needs to complete the proposed wide age range MRCV campaigns across all the states as early as possible to have required population immunity that will prevent outbreaks and stop transmission of measles and rubella.
- Vaccine supply must be available for such a mass campaign, target population ~ 400 million (9 months < 15 Years).
- India needs to plan for subsequent follow up campaigns with MRCV targeting age cohorts as evidenced from the country's MR surveillance data.
- India needs to develop an improved communication framework for effective social mobilization that would boost immunization coverage and enhance herd immunity to prevent outbreaks of measles/rubella.
- India needs to have state wise seroprevalence data for both measles and rubella along with regularly evaluated coverage for measles and rubella vaccines to measure population immunity and map out susceptible cohorts and guide immunization strategies.
- Sustained resources for NPSP beyond polio eradication to support campaign preparation, monitoring, accountability and surveillance.

Country Case Studies - Federal Democratic Republic of Nepal

21. Demographics

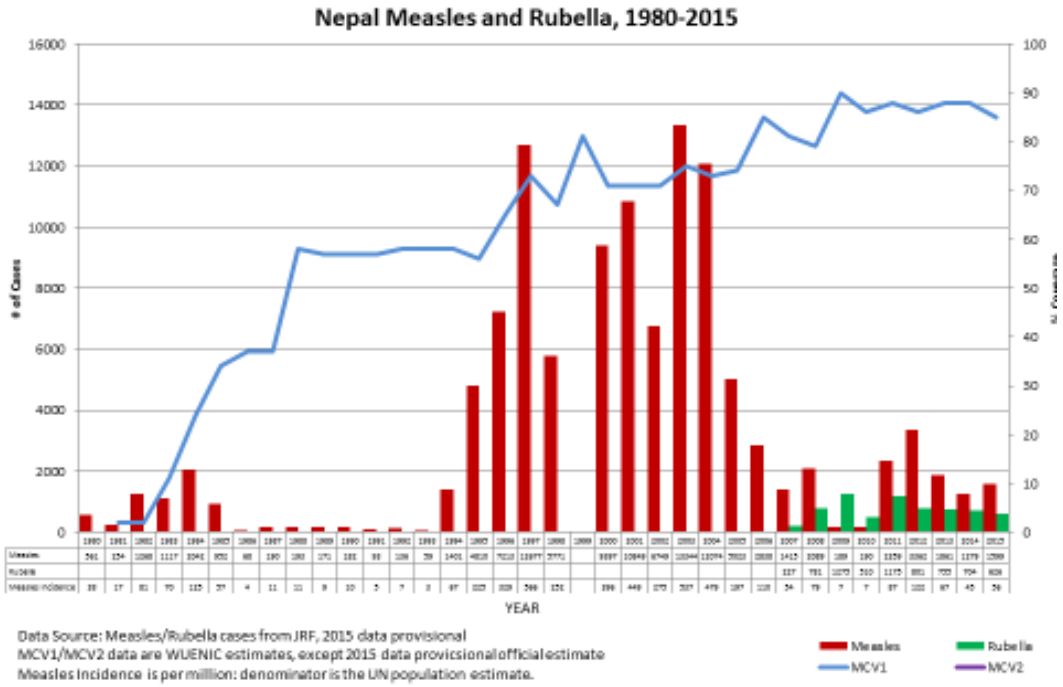
Nepal shares a long and porous 1800 kilometre border with India.

Total population	27,311,978
Live births (LB)	662,285
Children <1 year	628,824
Children <5 years	2,808,179
Children <15 years	9,941,560
Pregnant women	761,661
Child bearing age women (15-49 years)	7,387,284
Neonatal mortality rate	24 (per 1000 LB)
Infant mortality rate	34 (per 1000 LB)
Under-five mortality rate	42 (per 1000 LB)
Maternal mortality ratio	190 (per 100000 LB)

Division/Province/State/Region	5
District	75
Municipality	58
Village development committee	3,915
Ward	36,041
Population density (per sq. km)	181
Population living in urban areas	17%
Population using improved drinking-water sources	88%
Population using improved sanitation	37%
Total expenditure on health as % of GDP	6.1
Births attended by skilled health personnel	36%
Neonates protected at birth against NT	82%

22. **Summary of progress towards regional measles/rubella targets as of 2014 (WUENIC and JRF data).**

Nepal has made good progress towards Measles elimination and has developed a platform to build on it. However, the country needs to work a lot on improving the population immunity as well as the sensitivity of the surveillance system.



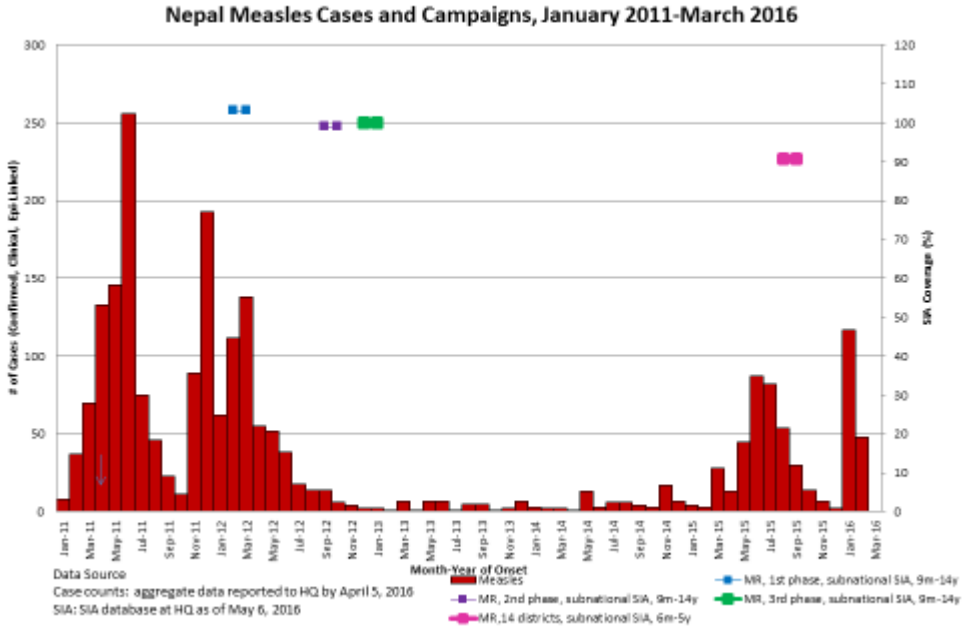
23. Five key strategies

a. Has the country achieved and maintained high population immunity through vaccination with 2 doses of M/MR/MMR vaccine?

Not yet. Nepal has obtained high population immunity through combined strategy of single dose MCV1 at 9 months and periodic SIA, MCV2 has not yet been introduced. However, to sustain this Nepal will have to strengthen its routine immunization and have high coverage at both national and subnational level with routine immunization.

MCV Supplementary Immunization Activities, Nepal, 2014-2013

Year	Vaccine, geographic coverage, target group	Target	Coverage Achieved
2004-2005	M, nationwide, 9 months to 15 years	9,423,866	104%
2008	M, nationwide, 9 months to 5 years	3,903,515	93%
2012-2013	MR, nationwide, 9 months to 15 years	9,579,306	101%



Nepal has adopted the goal to eliminate measles and control rubella/CRS by 2019, one year ahead of the regional milestone of 2020. Nepal has achieved high MCV1 coverage for routine immunization and has periodically conducted catch-up and follow-up campaign to vaccinate susceptible cohorts of population that have developed over time. However, MCV2 was not introduced until 2015. MCV1 given at 9 months of age was introduced along with diphtheria-pertussis-tetanus vaccine and tetanus-toxoid vaccine, as a pilot in three districts in 1979, and then scaled-up nationwide in 1989.

In Nepal, estimated MCV1 coverage increased from 81% in 2007 to 88% in 2014. Reported MCV1 coverage was <90% in 38 (51%) districts, 90%–95% in 15 (20%) districts and ≥95% in 22 (29%) districts in 2014. During 2000–2014, Nepal conducted three nationwide SIAs, reaching approximately 22.7 million children with measles-containing vaccine. The first SIA was a nation-wide catch-up measles vaccination campaign in 2004-05 targeting children 9 months to <15 years achieving more than 100% administrative coverage. Subsequent a follow-up measles vaccination was conducted in 2008 targeting children aged 9 months–4 years, achieving 93% administrative coverage. The last SIA was a nation-wide catch-up measles-rubella (MR) vaccination conducted in 2012–2013 targeting 9 months to under 15 years children achieving 100% administrative coverage, following which MR vaccine was introduced into national routine immunization schedule at the age of 9 month. In 2015, SIAs were conducted in 14 district targeting 6m to 5 years old children.

b. Has the country develop an effective disease surveillance system supported by a WHO accredited laboratory?

Progressing. In March 2003, government of Nepal and WHO initiated a comprehensive measles case-based surveillance system integrated into the existing acute flaccid paralysis (AFP) surveillance supported by surveillance medical officers (SMOs) providing weekly and monthly detailed data on measles cases through reports from major health-care centres and hospitals throughout all 75 districts of the country. This system includes all inpatient facilities, and covers approximately >10% of all government health facilities.

Laboratory surveillance expanded from 31 health facilities to 212 sites by 2010 and to 299 by in 2014. Efforts were made to collect blood samples from each and every suspected measles case who attended these health facilities and sent to a proficient national measles-rubella laboratory in NPHL and tested for measles and rubella IgM using enzyme-linked immunosorbent assay. The enhanced measles surveillance also unfolded previously unknown rubella burden in Nepal. Nepal established a good integrated surveillance system meeting most of the core surveillance indicators. A number of clinically-compatible cases are still being reported in the laboratory-supported case-based surveillance system. Nepal thus needs to enhance the sensitivity of its laboratory-supported case-based surveillance by using sensitive case definition for suspected measles cases and expanding surveillance to community level through involvement of health extension volunteers as well as expansion of laboratory capacity to test more suspected cases. Nepal also should start genotyping of sporadic measles cases as it moves closer to elimination.

c. Has the country been successful in conducting outbreak preparedness and response?

Yes. The country has an outbreak preparedness and response plan and has a rapid response team active in all the districts supported by the network of SMOs. Nepal has successfully conducted outbreak response since 2000. During 2000 –2014, around 637 suspected outbreaks were reported, of which 622 (98 %) were fully investigated and responded to with appropriate measures.

d. Has the country developed communication strategies to build public confidence in vaccination?

Yes. As is an integral part of each SIA strategy conducted by Nepal since 2004-05.

e. Has the country implemented innovative strategies or conducted operational research to access previously unreached communities with vaccination services and/or disease surveillance capability?

Yes. The country has tried to map all the hard to reach population and used innovative strategies to achieve high coverage of vaccination all over the country. In 2011, an innovative approach called the "Fully Immunized Village" strategy was adopted aiming to achieve 100% coverage with all routine vaccinations within the administrative boundary of each village using a technique called "Appreciative Inquiry" that offers processes and potential for the community to positively explore, collectively imagine, collaboratively design and jointly commit to strengthen routine immunization and MCV coverage. By 2014, 823/3915 (21%) villages and 10 (13%) districts were declared fully immunized and a target was set to have the entire country declared fully immunized through routine immunization services by 2017.

24. What were/are the critical success factors?

16. Good commitment from the government and high commitment of frontline workers have been key to success. Nepal has also formalized its commitment to Immunization program through endorsement of Immunization Act in 2015 to ensure that safe and quality vaccine are available to all children in the country.

17. Traditional vaccines are fully funded and have a line item in its National plan providing sustainable financing through the government budget.
18. Signed a partnership with Lions International, Nepal Paediatric Society, UNICEF and WHO for Measles elimination and rubella and CRS control at country level.
19. AFP surveillance network supports case-based measles surveillance.
20. Nepal also has an active National Immunization Technical Advisory Committee to provide technical support to the Immunization program of Nepal

9. What were/are the significant barriers to achieving targets?

The key barriers are:

10. Coverage of MCV1 is not optimal as desired in the regional strategy and as MCV2 introduction recently happened reaching high coverage will take time. Difficult geographical access to reach pockets of populations in high mountains and hills has compounded the problem.
11. Socio-cultural attitude towards measles like cases, so these are not considered as disease needing medical attention and thus are confined at homes. Not all cases come to the contact of health system and even if they come they are not systematically reported by the extension health workers or volunteers. The surveillance system is thus not able to pick up all the cases.
12. Natural calamities like the big earthquake that happened in April 2015 disrupts the entire immunization program for number of months.
13. Political unrest that have disrupted the routine immunization in the Terai region (south western flat lands) for a number of months.
14. Open and porous border with India will sustain steady importation until the country conduct a wide-age range nationwide MR campaign.

10. Conclusion

1. What can be achieved by 2020 with current projected resources

Nepal has created a solid foundation and platform to eliminate measles and rubella and need to build on it. The current goals are achievable provided that the routine immunization is strengthened and the sensitivity of case-based MR surveillance is enhanced.

2. What additional activities, strategies/tactics, and resources are needed to achieve, or maintain, the regional targets

Nepal needs to close the immunity gap in the population not only by campaigns but through strengthening routine immunization and the current strategy of Fully Immunization Village is an opportunity and an aggressive expansion of this approach would be required to achieve the goal.

Cross border notifications and synchronization of SIAs, with India must be initiated.

Nepal would also need to expand its case-based surveillance to community-based surveillance and enhance the sensitivity of the surveillance by revision on the definition of suspected cases and subsequent revisions.

Country Case Study - Democratic Socialist Republic of Sri Lanka

25. Demographics

Total population	20,675,000
Live births (LB)	349,715
Children <1 year	346,253
Children <5 years	1,778,050
Children <15 years	5,210,100
Pregnant women	349,715
Women of child bearing age (15-49 years)	5,292,800
Neonatal mortality rate (per 1,000 LB)	6.8
Infant mortality rate (per 1,000 LB)	9.2
Under-five mortality (per 1,000 LB)	10.4
Maternal mortality ratio (per 100,000 LB)	37.7

Division	9
District	26
Health area Medical Officer (MOH)	337
Population density (per sq. km)	324
Population living in urban areas	18%
Total expenditure on health as % of GDP	3.3%
Births attended by Skilled health personnel	99%
Neonates protected at birth against NT	95%

(Source- EPI Fact 2014, Published by WHO SEARO, Accessed on 1-02-2014 at http://www.searo.who.int/entity/immunization/data/epi_factsheet_sri_lanka_2014.pdf?ua=1)

Since the program's inception in 1978, EPI services have been integrated as a component of comprehensive health care services. Immunization is carried out along with the Maternal and Child Health (MCH) services. MCH programs are delivered through Medical Officer of Health (MOH) offices and MCH clinics. Almost all MCH clinics are conducted by the MOH family health workers and Public Health nursing Sisters who work under the Regional Directors of Health Services (RDHS). In some hospitals, maternity homes, and central dispensaries, institutional Medical Officers conduct the clinics with the assistance of field health staff. A school-based vaccination delivery program is in place and conducted by the MOH of the relevant area with the assistance of field level public health staff.

Private hospitals and general practitioners also provide immunization services to the community. Private practitioners receive EPI vaccines from the government free of charge upon request. Vaccinees receiving these vaccines are only charged for professional services. The private sector also offers non-EPI vaccines.

The country has set the following measles rubella elimination targets:

- <5 measles cases/ million population by 2015 & < 1 case per / million population by 2018
- <10 Rubella cases/ million population by 2018
- < 1 CRS case/ 100,000 Live births by 2018

Elimination strategies:

- Maintain high immunization coverage (at the age of 1 & 3 years)
- Active surveillance : case based surveillance
- Outbreak prevention and adequate investigation of outbreaks
- Adequate case management

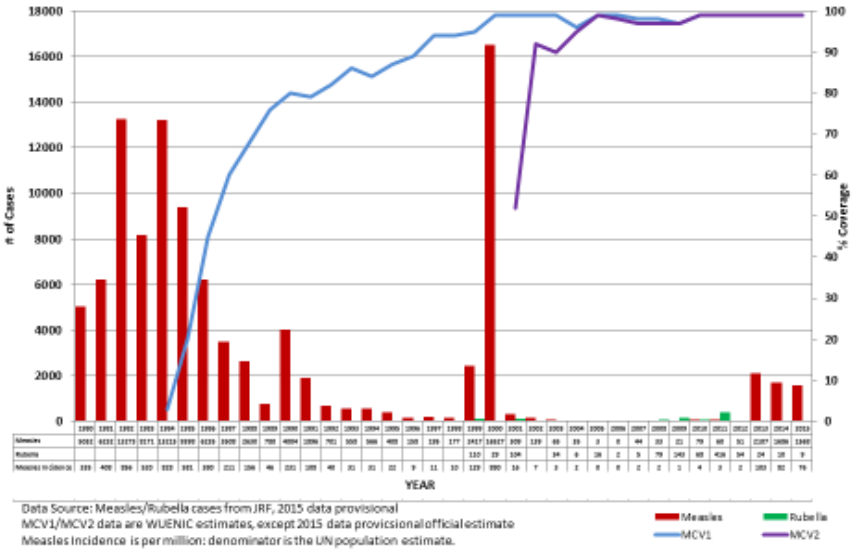
26. **Summary of progress towards regional measles/rubella targets as of 2014 (WUENIC and JRF data).**

The country has made good progress against the regional measles and rubella targets on immunization and raising immunity profile against measles and rubella. However, the country needs to work on achieving the targets on laboratory supported surveillance. Ref. Attachment –A-Tables 1and 2.

27. Five key strategies

a. Has the country achieved and maintained high population immunity through vaccination with 2 doses of M/MR/MMR vaccine?

MCV1 & MCV2 coverage[1] and Measles cases[2], Sri Lanka 1980-2015



Yes. The country has maintained high population immunity for the last three decade through high coverage of routine MRCV1 and MRCV2, as well as through periodic SIAs based on the local epidemiology. Sri Lanka has a strong Immunization program with sustained high coverage in routine immunization from all the antigens for the last decade. Vaccination service is provided at the integrated clinics and hospitals and all the vaccination records are maintained at clinic level which covers the population of its catchment area.

The country has introduced both measles and rubella containing vaccines in the routine immunization program and the history of introduction is as follows:

Year	Vaccine	Schedule
1984	Measles only	9 months
1996	Rubella only	16-44 years and 11-15 years
2001	MR as MCV-2	3 years (2nd dose)
2011	MMR replacing MR	1st dose : 12 months; 2nd dose : 3 years
2015 April	MMR	Changes MMR schedule from 12 months to 9 months

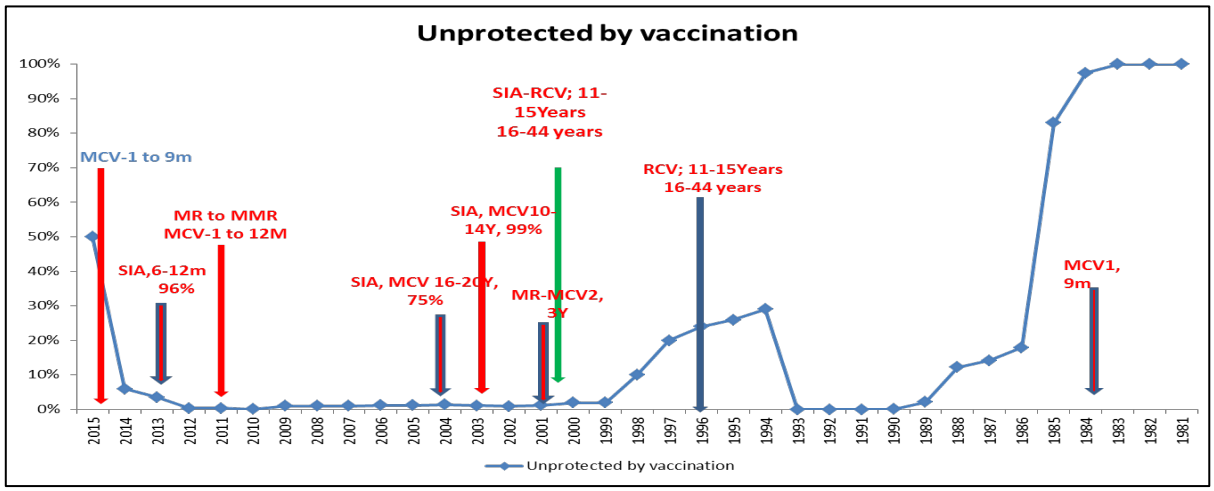
The country also conducted periodic Supplementary Immunization Activities (SIAs) to reduce immunity gap against measles and rubella

Year	Vaccine	Target age	Coverage
2001	Rubella	10-14 years : 16-44years	80% and 60%

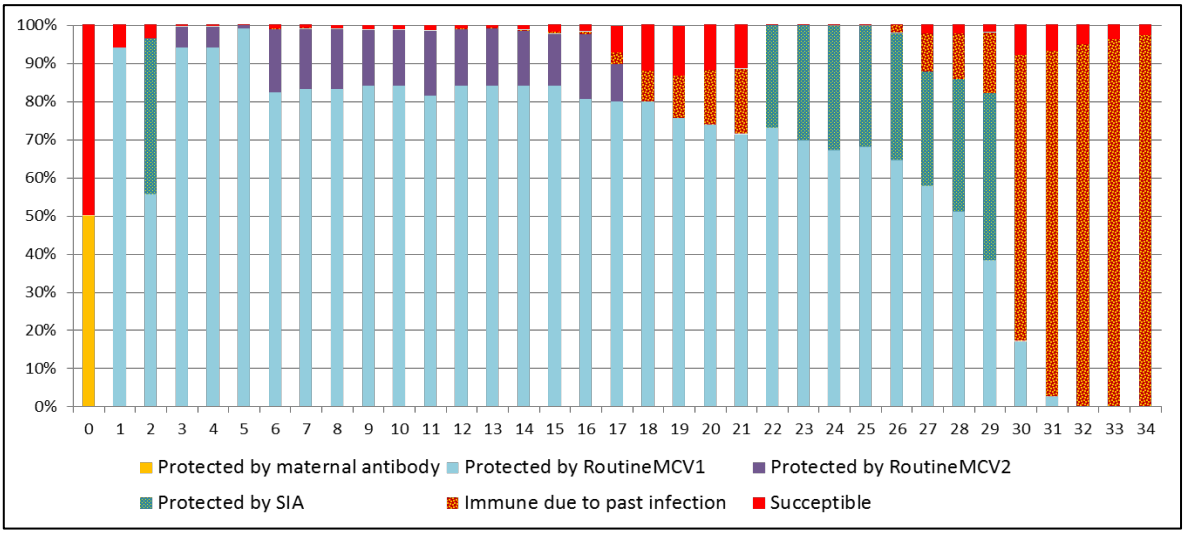
Year	**Vaccine**	**Target age**	**Coverage**
2003	Measles	10-14 years :	95%
2004	MR	16-20years :	72%
2013	Measles	6-12 months :	99%

A review of vaccination history in 2015 revealed that some gaps in population immunity around ages 17-21 years and above 31 years who might not have been fully protected.

Estimation of Susceptibility to Measles
based on reported immunization coverage in 0-34 years of age, Sri Lanka 2015

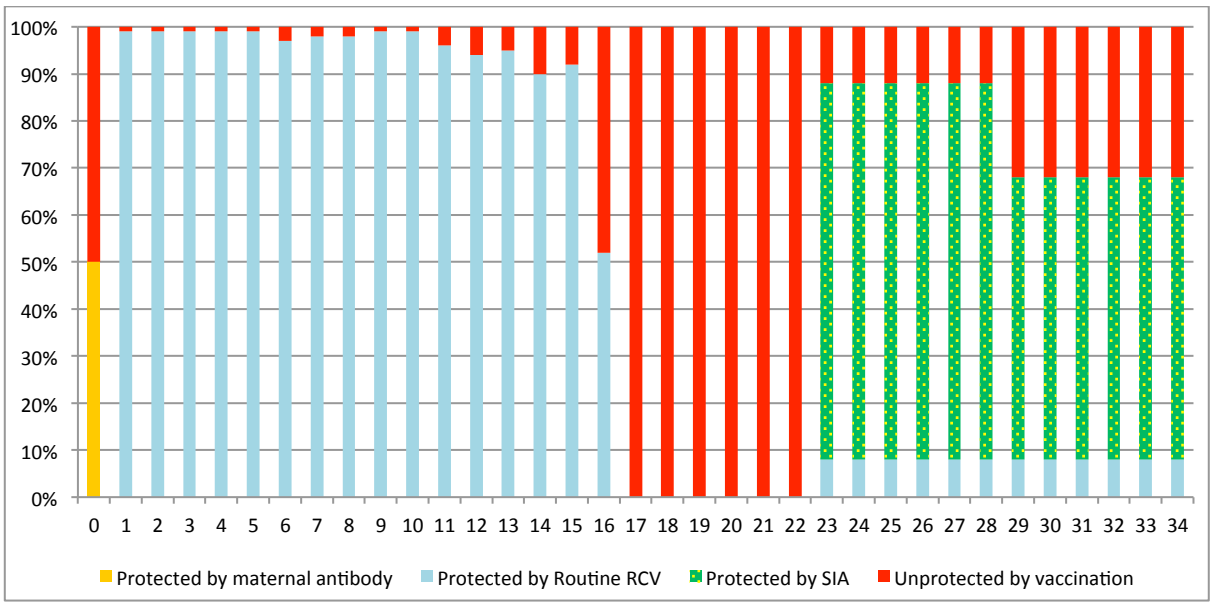


Estimation of Measles susceptibility based on reported vaccination coverage in 0-34 years of age Sri Lanka, 2015



Similarly the Immunity for Rubella up to the age of 34, based on the immunization program history, shows some immunity gap in women aged 17-22years unless they have been protected by natural immunity.

Estimation of Rubella susceptibility based on vaccine coverage in 0-34 years of age, Sri Lanka



b. Has the country develop an effective disease surveillance system supported by a WHO accredited laboratory?

Yes but needs improvement. Sri Lanka conducts integrated national surveillance for 28 diseases including measles, rubella and CRS. Surveillance is conducted at MOH level, all cases are reported by health facilities at the community level and by active surveillance thanks to MOH area surveillance officers. A case-investigation form in line with the global recommendation is available at the MOH level. However, the current system of notification of measles like cases is hospital based admissions only. In the hospitals, active rounds are done daily by ICN (infection control nurses) in the inpatient

wards to look for notification forms for measles, rubella and CRS and report to respective MOH area. Chances of not notifying cases is high if they are from OPDs and/or from the private sectors.

Case-based surveillance for VPDs in MOH areas communities are not linked to lab results, thus investigation forms remain incomplete at MOH (Medical officer of health) level as they do not necessarily get the laboratory results from the National Public Health Labs specimen been collected in hospitals and results reported back to them. There is also no documentation of active case search, or contact tracking except for Dengue for measles like cases.

Rates of laboratory investigation of suspected measles cases were less than the recommended standard of 80% for the last five years.

For specimen collection, the mode time taken to collect blood specimen from onset of rash was 5 days which was well within the recommended 3-28 days with an average of 8.43 days (range 0-81). The mode time taken from date of onset of rash to test the blood sample was 10 days with an average of 16.67 days (range 2-111 days) which leaves a lot of time for the child to infect the community as the child.

The quality of field and laboratory surveillance for measles and rubella for 2012 to 2014 shows the following:

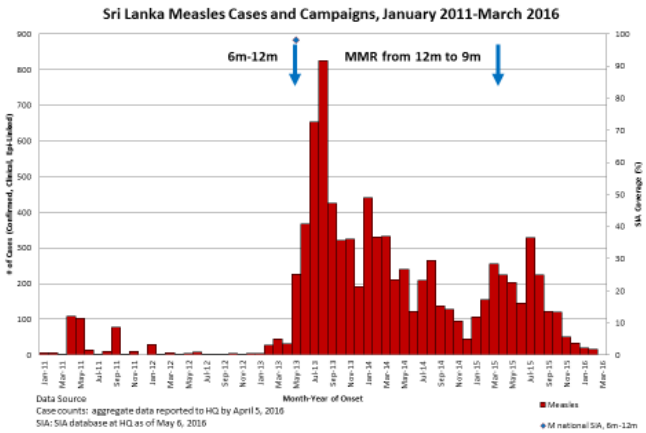
Year	No. of Suspected Measles	Indicators					
		Annual incidence of confirmed Measles cases per million total population	Annual incidence of confirmed Rubella cases per million total population	Proportion of measles and rubella cases that have had an adequate investigation initiated within 48 hours of notification	non-rubella incidence per 100,000 total population	Proportion of sub-national administrative units reporting at least two discarded non-measles non-rubella cases per	Proportion of sub-national surveillance units reporting to the national level on time
2012	147	2.5	2.7		0.27		100%
2013	4,080	202	1.2		2.99		100%
2014	3,117	115	0.5		2.75		100%

Year	% Serum specimen collected from	Total Serum Specimen received in Laborat	% serum specimens tested	% Specimen Positive for Measles IgM	Specimen Positive for Rubella IgM	% Results within 4 of receipt	% Outbreak tested for viral detection	Genotypes detected	
								Measles	Rubella

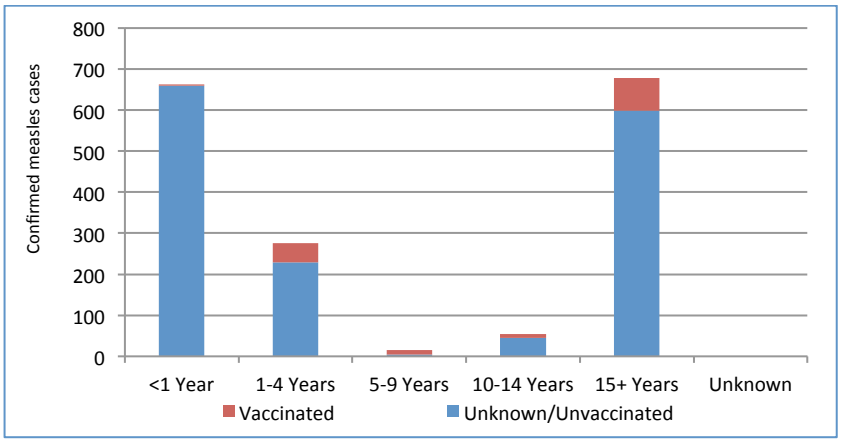
	suspected measles cases	ory							
2012	57	84	100	8	50	68	ND	ND	2B
2013	81	3,299	72.1	74	4	46	ND	ND	ND
2014	69	2,151	98.7	73	11	75	ND	B3	ND

c. Has the country been successful in conducting outbreak preparedness and response?

Not really. The country has been experiencing an outbreak of measles since January 2013 which only tapered-off at the beginning of 2016. As a large proportion of cases were in the <1 year age group, in June 2013, a nation-wide narrow-age range (6 months to 12 months) measles SIA was conducted achieving a high coverage of 96%. Then, in April 2015, based on disease epidemiology, MRCV1 it moved from 12 month to 9 month.



Confirmed measles cases by age and vaccination status, Sri Lanka, 2014 (N: 1686)

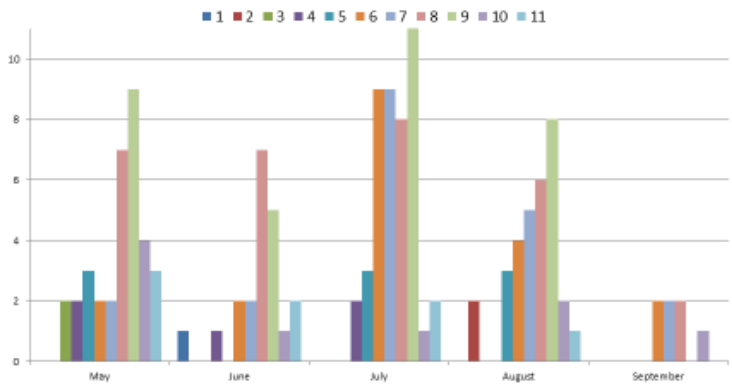


Despite many efforts the country was not able to curtail the outbreak because:

- Definition of measles outbreak was not clear to the epidemiologists in a number of areas and thus the current outbreak was not treated as outbreak and no adequate responses done.
- The surveillance system was more targeted towards surveillance of dengue and complacency was seen towards measles surveillance.
- Most cases had "point source" as hospitals or confined environment like factories and the need to prevent nosocomial infection and develop good infection control practice took time as it was not acknowledge early enough.

As expected, the change of MRCV1 to 9months did not immediately change 1yr case distribution – unfortunately no age-specific data could be obtained after September 2015 and cases continued to be reported up to beginning of 2016.

Cases Age distribution after change of MRCV1 to 9mths in April 2015 (n=465 out of 568 in 2015 up to Sept.)



d. Has the country developed communication strategies to build public confidence in vaccination?

Yes, the country has a long standing history of having communication strategies to build public confidence in vaccination. In fact in each of the immunization clinics, time is devoted to talk about vaccination and its importance to the mother who come to vaccinate their child as part of its communication strategy. A protocol currently exists for risk communication which centralizes communication with media to the Epidemiology Unit with support from the Communications Unit (Health Education Bureau) within the Department of Health Services.

e. Has the country implemented innovative strategies or conducted operational research to access previously unreached communities with vaccination services and/or disease surveillance capability?

Yes, the country has implemented a number of innovative strategies to reach the unreached population. Most of the migratory and unreached population due to previous political unrest in the country have been mapped and vaccination service provided to them.

28. **What were/are the critical success factors**

Sri Lanka is an example of a successful immunization program. The government has huge ownership of the program and the government funds the entire immunization program with sustained immunization funding for last one decade. The key success factors are:

1. Longstanding and strong commitment to EPI at all levels, as evidenced in the consistently high coverage achieved with all antigens across all districts;
2. Stable funding: Sri Lanka's dedicated budget line for vaccines and the percentage of vaccine and routine immunization costs borne by the government provide a strong financial base for the program;
3. A proactive, broad vision for EPI as evidenced by the nature of the Immunization Policy developed in 2014;
4. A well-established and competent decision-making body for Immunization - Advisory Committee for Communicable Disease (ACCD), a committee constituted of Directors of Departments in the Department of Health Services as well as nationally recognized subject matter experts;
5. Well established public health system with good recording and reporting system. Every child is accounted for and is recorded in the household registers in the community-clinic and the registration rate has been found to be close to 99%. The country also has introduced an electronic recording system, and rolled-out electronically-based information systems
6. An extremely well trained and dedicated work force from the highest level to frontline staff.
7. Strong School Health Program owned by Ministry of education and providing vaccination: Td to Grade, Rubella to Grade 8, OPV and DT to Grade 1.

29. **What were/are the significant barriers to achieving targets**

The country seems to be in right track to achieve the targets and has all the components to achieve the regional targets. However, the surveillance performance indicators have shown that the country needs to strengthen its laboratory supported surveillance system to pick up all the measles cases from the community. It needs to, integrate case-base and laboratory surveillance and follow the model used for dengue control program surveillance. The surveillance system seems to be complacent and overwhelmed by other priorities like the surveillance of Dengue and thus the case investigations are mostly incomplete with no contact tracking and no laboratory confirmations.

30. Conclusion and lessons learned

a. What can be achieved by 2020 with current projected resources

The country is well in line to achieve the regional goal of measles elimination and rubella/CRS control by 2020. The country will probably also eliminate rubella by the given time frame and with the available resources.

b. What additional activities, strategies/tactics, and resources are needed to achieve, or maintain, the regional targets

Considering other disease burden, measles and rubella are currently not seen as a public health problem by front line health cadres and thus there is some level of complacency in the surveillance of measles and rubella. There is a need to link the laboratory and surveillance team to have an effective laboratory supported case based surveillance for measles and rubella as well as to ensure that all cases from community, private sector and hospital are captured.

a) Continue with the high level of government commitment as currently seen for vaccination program.

b) Review regularly disease pattern post schedule change and make necessary adjustment if required

c) The country will have to review its surveillance guidelines and address some areas like
   - Strengthen surveillance system by having active surveillance with a network of community informant like in Dengue
   - Conduct Regular sub-national risk assessment for measles and rubella followed by plans to reduce the risk as possible every 2 years.
   - Link Lab data to EPID data at central as well as MOH level
   - Secure proper reagent supply
   - Involve private sector in measles notification and initiate Hospital based reviews of surveillance system
   - Enhancing the sensitivity of Measles case definition, introducing an elimination standard Outbreak definition for measles with active contact tracing
   - Revision of CIF with Standardized instruction on contact tracking and case investigations
   - Revision of the algorithm for CRS detection in line with the Regional guidelines
   - Optimize MCV2 dose to match epidemiology
   - Have an outbreak preparedness and response plan for the country for all VPDs

Lessons learned

When low susceptibility to measles has secured interruption of transmission but left some susceptible groups due to the change in schedule, different target age campaign and coverage achieved, country has to 1) regularly monitor the susceptibility profile of the population; 2) secure optimal surveillance of rash and fever illness; 3) consider any confirmed case of measles/rubella as **an outbreak** and take immediately the appropriate control measure with convincing communication to secure full political engagement, support from the Health and Education sector and participation from the civil society.

WPR Executive Summary – Jean-Marc

Status, key findings

In the WPR Region, all countries but 3 (Lao PDR, Salomon Islands, Vanuatu) have two doses of MCVR-containing vaccine in their routine immunization schedules. By 2016, all countries are using RCV. Since 2009, MCV1&2 coverage have been systematically over 90% at national level but great variation exists with countries with only 33% of countries having MCV1 >90% nationally and >80% in all districts – district data not available in 3 countries Fiji, Japan, New Zealand.

Up to end of 2015, 6 countries (Australia, Macao, Republic of Korea, Cambodia, Brunei Darussalam, Japan) have interrupted endemic transmission for more than 36 months as declared by the Regional Verification Commission. Lowest ever regional incidence was experienced in 2012. From 2013, resurgence of endemic transmission occurred in China and the Philippines and large scale outbreaks following importations in Vietnam, Papua New Guinea, States of Micronesia, Solomon Islands, Lao PDR and most recently Mongolia whose outbreak is still continuing after over a year. Recent outbreaks of measles have occurred primarily in unvaccinated under 5 year old children and 15 to 25 years old not been covered by SIAs.

Although measles case based surveillance is functioning in all countries/areas, rubella is not yet (e.g., New Zealand) or only recently in process (e.g., China) to be made a notifiable condition. CRS surveillance is just being rolled out at some sentinel sites in countries (e.g., Mongolia, Papua New Guinea, Philippines).

Conclusions and Recommendations

The WPR region has all the ingredients to succeed in eliminating measles and rubella: High MCV1&2 and MCV-SIAs coverage, a good case base and lab surveillance and a strong regional commitment with a committed Regional Verification Commission. However, some issues have to be addressed:

- Reliance on "reported coverage" over estimating real coverage and underestimating number of susceptible and not routinely discriminating coverage at lower administrative level.
- Follow-up SIA, usually organized too late and not with a large enough age group
- Case-base and laboratory surveillance system (building up in China) not systematically used for early case detection and opportune detailed analysis of outbreaks
- Increased infection and transmission of measles virus among people outside the target of current immunization strategies (i.e. infants aged $\leq$8 months, adolescents and adults)
- In large countries, adjusting SIA target age groups to Provincial age specific attack rate
- At the difference of polio, the is no major donor to the program and as the region is developing fast, less and less countries can avail from GAVI funding necessitating more national funding
- In case of an outbreak, health services not fully implementing infection control measures to prevent nosocomial transmission of measles
- De-centralization and lack of commitment to the regional goal of elimination at the state or provincial level remains a barrier particularly in several priority countries e.g. China, Malaysia, Philippines and Viet Nam.

- Contrary to polio, a champion funder in the region is absent.

It is expected that the ongoing revision of the Regional Strategies & Plan of Action 2016-2020 will address some of these issues.

6 WPRO Regional Status

6.1 Regional control and/or elimination targets

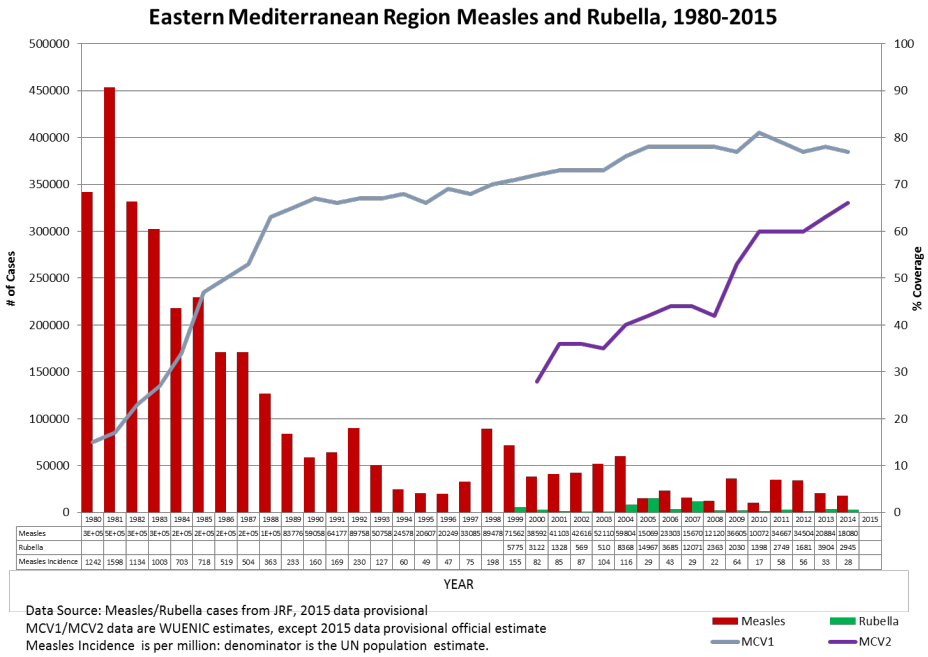
a. Measles target: 2012

b. Rubella target: to be determined

Comment

Last case of indigenous polio was reported in 1997, Regional polio certification achieved in 2000 and Regional Measles elimination goal set in 2003.

6.2 Summary of progress towards regional targets (Table 1)



6.3 Summary on progress towards regional measles elimination

- In 2010-2015, most of priority countries in the Region conducted WHO-recommended immunization strategies for measles elimination.
  - All of 4 countries with the largest population in the Western Pacific Region i.e. China, Japan, Philippines, Viet Nam and other countries with large population i.e. Cambodia, Lao PDR and Papua New Guinea conducted at least one nation-wide mass vaccination campaign with MCV in 2010-2015.
  - China, Viet Nam, Cambodia and Lao PDR marked >95% MCV coverage and Philippines and Mongolia marked >90% MCV coverage in the campaign.
  - China, Hong Kong, Mongolia and Republic of Korea have maintained >95% vaccination coverage with both MCV-1 and MCV-2 since 2010.
  - Viet Nam has maintained >95% vaccination coverage with MCV-1 since 2010 and improved MCV-2 coverage from 83.2% in 2012 to 94% in 2014.

- Overall, almost all non-PICs (except Lao PDR, PNG and the Philippines) achieved >90% vaccination coverage with both MCV-1 and MCV-2 in 2010-2014

- In 2012, the Region marked historically lowest regional measles incidence.
- In 2010-2015, the surveillance activities required for measles elimination have continued to improve across the Region. A Measles-Rubella Bulletin is published monthly.
- In March 2013, the Regional Verification Commission (RVC) for Measles Elimination in the Western Pacific verified that Australia, Macau, Mongolia and the Republic of Korea had interrupted endemic transmission for more than 36 months since 2009.
- In March 2014, the RVC verified that Cambodia, Brunei Darussalam and Japan had interrupted endemic transmission for more than 36 months since 2010.
- New Zealand: <36 months since achieving interruption of endemic measles transmission.
- Hong Kong SAR (China) and Singapore may be ready for verification but additional information needed.

Summary of Progress toward Regional Targets

<table>
<tr><td>Indicator</td><td colspan="5">Regional Status for most recent year available (2014 or 2015)</td><td>Comment</td></tr>
<tr><td rowspan="14">No. (%) of countries with MCV1 ≥90% nationally and >80% in all districts.</td><td colspan="5">12 (33%) of countries with MCV1 >90% nationally and >80% in all districts.</td><td rowspan="14">Of the 36 countries, 6 do not have JRF (data for 2014), 2 do not have data on MCV coverage (KIR and WSM), 3 do not have data on district (FJI, JPN, NEZ), and 1 does not have data on national coverage and district (GUM).

*data for 2015 are not yet available</td></tr>
<tr><td rowspan="2">Country</td><td colspan="2">MCV1 Coverage nationally</td><td colspan="2">% Districts with >80% MCV1 coverage</td></tr>
<tr><td>2014</td><td>2015</td><td>2014</td><td>2015</td></tr>
<tr><td>AUS</td><td>93.2</td><td></td><td>100</td><td></td></tr>
<tr><td>KOR</td><td>99.6</td><td></td><td>100</td><td></td></tr>
<tr><td>MAC</td><td>93.3</td><td></td><td>100</td><td></td></tr>
<tr><td>MNG</td><td>98.3</td><td></td><td>100</td><td></td></tr>
<tr><td>JPN</td><td>97.5</td><td></td><td>ND</td><td></td></tr>
<tr><td>KHM</td><td>94</td><td></td><td>83</td><td></td></tr>
<tr><td>BRU</td><td>97</td><td></td><td>100</td><td></td></tr>
<tr><td>CHN</td><td>99</td><td></td><td>91</td><td></td></tr>
<tr><td>PHL</td><td>88</td><td></td><td>73</td><td></td></tr>
<tr><td>MAA</td><td>94</td><td></td><td>74</td><td></td></tr>
<tr><td>VNM</td><td>97.4</td><td></td><td>97</td><td></td></tr>
<tr><td rowspan="12">No. (%) of countries with MCV2 >90% nationally and >80% in all districts.</td><td colspan="5">14 (39%) of countries with MCV2 >90% nationally</td><td rowspan="12">No data on countries with >80% in all districts.
MCV2 not included in 3 countries: Lao PDR, Salomon Islands, Vanuatu
Among the 36 countries, 6 do not have JRF (data for 2014), 7 do not have data on MCV2 national coverage
Coverage data not always consistent with verification status
*data for 2015 are not yet</td></tr>
<tr><td rowspan="2">Country</td><td colspan="2">MCV2 Coverage nationally</td><td colspan="2">% Districts with >80% MCV2 coverage</td></tr>
<tr><td>2014</td><td>2015</td><td>2014</td><td>2015</td></tr>
<tr><td>AUS</td><td>92.6</td><td></td><td></td><td></td></tr>
<tr><td>KOR</td><td>96.3</td><td></td><td></td><td></td></tr>
<tr><td>MAC</td><td>90.6</td><td></td><td></td><td></td></tr>
<tr><td>MNG</td><td>98.1</td><td></td><td></td><td></td></tr>
<tr><td>JPN</td><td>93.7</td><td></td><td></td><td></td></tr>
<tr><td>KHM</td><td>73</td><td></td><td></td><td></td></tr>
<tr><td>BRU</td><td>96</td><td></td><td></td><td></td></tr>
<tr><td>CHN</td><td>99</td><td></td><td></td><td></td></tr>
</table>

<table>
<tr><td></td><td>PHL</td><td>64</td><td></td><td></td><td></td><td rowspan="3">available
*no data on district coverage</td></tr>
<tr><td></td><td>MAA</td><td>98.9</td><td></td><td></td><td></td></tr>
<tr><td></td><td>VNM</td><td>93.8</td><td></td><td></td><td></td></tr>
<tr><td>No (%) of countries with RCV in their RI program</td><td colspan="5">By end 2015, all 37 (100%) countries and areas of the Western Pacific Region include RCV in RI</td><td></td></tr>
<tr><td>No. (%) of countries conducting SIAs with >95% in every district.</td><td>1/5 (20%) of countries that submitted reports of SIAs in 2014-2015 achieved >95% in every district.</td><td colspan="5">SIAs in 2014 - Coverage:
Cambodia: Selective SIA and no estimate at district level;
Lao PDR: National 100%; 16/18 provinces >95%; 131 (89%) districts >95%;
Micronesia: No report submitted.
Philippines: National 91%; 6/17 regions >95%; 83 (44%) districts >95%;
Solomon Islands: National 106%; 9/10 provinces >95%; 33 (70%) districts >95% coverage;
SIAs in 2015 - coverage:
Mongolia: No report submitted
Papua New Guinea: SIA continuing into 2016;
Vanuatu: National 100%; 5/6 provinces >95% coverage
Viet Nam: National 98%; 4/4 regions >95%; 704 (100%) districts >95%;</td></tr>
<tr><td>No. (%) of countries with measles incidence less than five cases per million population.</td><td colspan="5">9 (53%) of countries with measles incidence less than five cases per million population in 2015 (source: National measles and rubella monthly reports as of 20 January 2016)
<table>
<tr><td rowspan="2">Country</td><td colspan="6">Measles Incidence (per million population)</td></tr>
<tr><td>2010</td><td>2011</td><td>2012</td><td>2013</td><td>2014</td><td>2015</td></tr>
<tr><td>AUS</td><td>3.3</td><td>8.5</td><td>8.7</td><td>6.6</td><td>14.5</td><td>3.2</td></tr>
<tr><td>KOR</td><td>2.3</td><td>0.9</td><td>0.0</td><td>2.2</td><td>9.0</td><td>0.1</td></tr>
<tr><td>MAC</td><td>0.0</td><td>1.8</td><td>1.8</td><td>5.2</td><td>1.7</td><td>0.0</td></tr>
<tr><td>MNG</td><td>2.6</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.0</td><td>474.6</td></tr>
<tr><td>JPN</td><td>3.4</td><td>3.2</td><td>1.8</td><td>1.1</td><td>3.4</td><td>0.3</td></tr>
<tr><td>KHM</td><td>76.8</td><td>50.5</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.0</td></tr>
<tr><td>BRU</td><td>0.0</td><td>9.9</td><td>2.4</td><td>0.0</td><td>0.0</td><td>9.0</td></tr>
<tr><td>CHN</td><td>28.5</td><td>7.4</td><td>4.6</td><td>19.8</td><td>35.3</td><td>29.5</td></tr>
<tr><td>PHL</td><td>68.2</td><td>69.1</td><td>15.9</td><td>38.5</td><td>237.6</td><td>6.8</td></tr>
<tr><td>MAA</td><td>2.7</td><td>54.4</td><td>63.7</td><td>5.9</td><td>7.0</td><td>37.2</td></tr>
<tr><td>VNM</td><td>20.5</td><td>8.4</td><td>5.9</td><td>9.9</td><td>133.5</td><td>2.0</td></tr>
</table></td><td>The Pacific islands are considered as one epidemiological block</td></tr>
<tr><td>Number of estimated measles deaths, the percentage reduction since 2000, and number of deaths averted through</td><td colspan="5">40 estimated measles deaths in 2015. 10% reduction since 2003. (source: National measles and rubella monthly reports as of 20 January 2016)
<table>
<tr><td rowspan="2">Country</td><td colspan="6">Reported Measles Deaths</td></tr>
<tr><td>2010</td><td>2011</td><td>2012</td><td>2013</td><td>2014</td><td>2015</td></tr>
<tr><td>AUS</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>KOR</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>MAC</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>MNG</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td>JPN</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>KHM</td><td>6</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
</table></td><td>380 estimated measles deaths in 2003 (WPRO MR Bulletin Vol 1 Issue 2)

*total number of deaths was updated based on MNG's report as of 1</td></tr>
</table>

<table>
<tr><td>vaccination.</td><td>
<table>
<tr><td>BRU</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>CHN</td><td>39</td><td>10</td><td>4</td><td>3</td><td>26</td><td>33</td></tr>
<tr><td>PHL</td><td>34</td><td>28</td><td>5</td><td>0</td><td>117</td><td>3</td></tr>
<tr><td>MAA</td><td>0</td><td>4</td><td>0</td><td>0</td><td>1</td><td>2</td></tr>
<tr><td>VNM</td><td>1</td><td>4</td><td>0</td><td>0</td><td>3</td><td>0</td></tr>
</table>
</td><td>Feb 2016</td></tr>
<tr><td>Number of estimated CRS cases, the percentage reduction since 2000, and number of cases averted through vaccination</td><td>12 estimated CRS cases in 2014 (source: JRF data for 2014)
NA: Not applicable because of no surveillance
<table>
<tr><td rowspan="2">Country</td><td colspan="6">Reported CRS Cases</td></tr>
<tr><td>2010</td><td>2011</td><td>2012</td><td>2013</td><td>2014</td><td>2015</td></tr>
<tr><td>AUS</td><td>0</td><td>0</td><td>1</td><td>2</td><td>0</td><td></td></tr>
<tr><td>KOR</td><td>0</td><td>ND</td><td>1</td><td>1</td><td>0</td><td></td></tr>
<tr><td>MAC</td><td>ND</td><td>0</td><td>0</td><td>0</td><td>0</td><td></td></tr>
<tr><td>MNG</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td></td></tr>
<tr><td>JPN</td><td>0</td><td>1</td><td>5</td><td>31</td><td>9</td><td></td></tr>
<tr><td>KHM</td><td>ND</td><td>9</td><td>32</td><td>3</td><td>2</td><td></td></tr>
<tr><td>BRU</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td></td></tr>
<tr><td>CHN</td><td>ND</td><td>ND</td><td>ND</td><td>ND</td><td>ND</td><td></td></tr>
<tr><td>PHL</td><td>ND</td><td>ND</td><td>ND</td><td>ND</td><td>ND</td><td></td></tr>
<tr><td>MAA</td><td>0</td><td>ND</td><td>1</td><td>4</td><td>ND</td><td></td></tr>
<tr><td>VNM</td><td>ND</td><td>189</td><td>92</td><td>3</td><td>1</td><td></td></tr>
</table>
</td><td>3 estimated CRS cases in 2000 (source: JRF data for 2000)

*data for 2015 are not yet available</td></tr>
<tr><td>No. (%) of priority countries providing ≥ 50% op costs for SIAs</td><td colspan="2">1/11 (9%) priority countries conducted nationwide SIA and provided >50% of operational costs</td><td></td></tr>
<tr><td>No. (%) of MCV SIAs that include additional child health interventions.</td><td>At least 6/8 priority countries that conducted SIAs also included additional child health interventions.</td><td colspan="2">SIAs in 2014:
Cambodia: Selective SIA and other routine immunizations;
Lao PDR: OPV, vitamin A, mebendazole;
Micronesia: No report submitted.
Philippines: OPV;
Solomon Islands: vitamin A;
SIAs in 2015:
Mongolia: No report submitted
Papua New Guinea: All routine immunizations, vitamin A, mebendazole;
Vanuatu: OPV;
Viet Nam: No;</td></tr>
<tr><td>No. (%) of countries conducting routine immunization and AEFI training as part of SIA training</td><td>6/6 (100%) countries for which technical reports were submitted, routine immunization and AEFI training was part of SIA training.</td><td colspan="2">SIAs in 2014:
Cambodia: Selective SIA which included routine;
Lao PDR: training included both RI and AEFI;
Micronesia: No report submitted.
Philippines: training included RI and AEFI;
Solomon Islands: training included RI and AEFI;
SIAs in 2015:</td></tr>
</table>

		Mongolia: No report submitted Papua New Guinea: training included RI; Vanuatu: training included RI and AEFI; Viet Nam: training included RI and AEFI;
No. (%) of priority countries with MR surveillance review	1/11 (9%)	The strategic plan identifies 11 priority countries. Of these, Lao PDR conducted an integrated VPD surveillance review in 2015.

Note:

Light green shade*: countries verified in 2014 or 2015 having achieved measles elimination (AUS, KOR, MAC, MNG, JPN, KHM and BRU);*

Light red shade*: countries with measles endemic transmission and resurgence (CHN, PHL and MYS);*

Light yellow shade*: countries with nation-wide measles outbreak induced by measles virus importation (VNM, PNG, SLB)*

b. Comments on table 1 showing progress

Mortality and Morbidity

- "Measles incidence less than five cases per million population" seems to be a good indicator for monitoring overall progress toward elimination and verification status
- Since there is no reported number of "estimated" measles deaths in the Region, overall mortality and disease burden can be hardly estimated in the Region.

Surveillance

- Although measles case based surveillance is functioning in all countries/areas, rubella is not yet been (e.g., New Zealand) or only recently is in process (e.g., China) to be made a notifiable condition. CRS surveillance is just being rolled out at some sentinel sites in countries (e.g., Mongolia, Papua New Guinea, Philippines).

Measles and rubella surveillance indicators

Indicator	2013	2014	2015
Discarded non-measles rate[1]	3.6	4.2	3.9
% second level units with ≥ 2 discarded cases[1]	40.9%	52.0%	47.7%
% suspected cases with adequate investigation	91.6%	28.2%	79.4%
% suspected cases with adequate blood specimens	89.9%	84.2%	74.3%
% serology lab results ≤ 4 days of receipt	66.3%	31.3%	83.6%
% serology lab results ≤ 7 days of receipt	84.2%	40.7%	91.8%

[1] Per 100 000 population

In 2014, there was a marked decrease in the percent of cases with adequate investigation and percent of cases with timely laboratory results. This is related to the high number of suspected measles cases reported in 2014 that overwhelmed the epidemiologic and laboratory surveillance systems in the affected countries

- MR surveillance review should be carried out more often for priority countries.

SIA

- SIA for measles elimination has been a good chance to provide additional child health intervention (e.g. OPV, vitamin A, mebendazole, etc.) and a good opportunity for training on routine immunization program and immunization safety

6.4 Summary of implementation of each of the 5 key strategies

a. Achieve and maintain high levels of population immunity with two doses of measles and rubella containing vaccines;

1. Measles and Rubella vaccination and Coverage

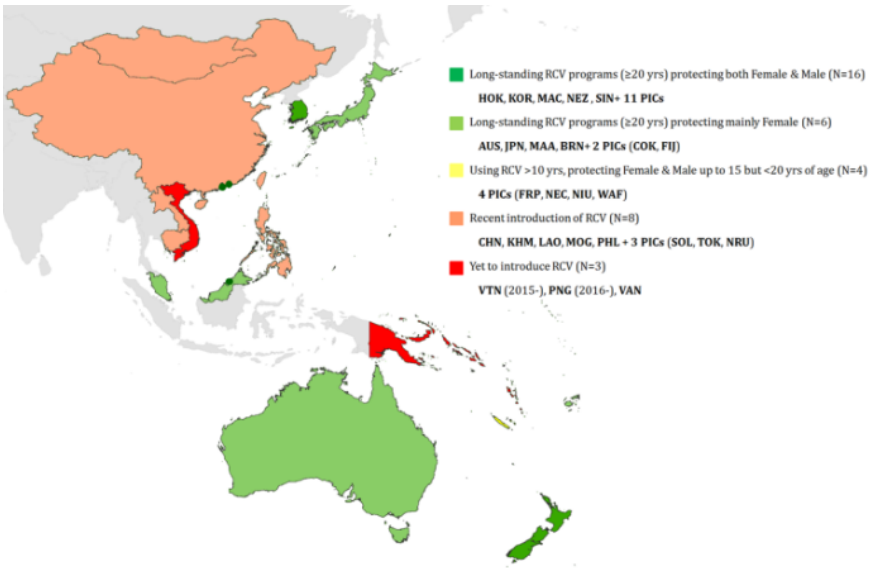
- China, Hong Kong (SAR), Mongolia and Republic of Korea have maintained >95% vaccination coverage with both MCV-1 and MCV-2 since 2010. Viet Nam has maintained >95% vaccination coverage with MCV-1 since 2010 and improved MCV-2 coverage from 83.2% in 2012 to 94% in 2014. Almost all non-PICs (except Lao People's Democratic Republic, Papua New Guinea and the Philippines) achieved >90% vaccination coverage with both MCV-1 and MCV-2 in 2010.
- Vaccination coverage of nationwide SIA carried out in Cambodia (2011 and 2013), China (2010), Lao People's Democratic Republic (2011 and 2014) and Viet Nam (2010) reached to >95%. Vaccination coverage of nationwide SIA carried out in Mongolia (2012) and the Philippines (2014) reached to >90%.
- Nine of 16 non-PICs introduced rubella-containing vaccine (RCV) into the routine childhood immunization program more than 20 years ago. Five non-PICs have introduced RCV since 2007 (Cambodia, China, Lao People's Democratic Republic, Mongolia, and the Philippines) and two countries (Papua New Guinea and Viet Nam) will introduce RCV in the national immunization program in 2015.

Vaccination Coverage by Country in the WPR, 2010-2014

Country	MCV-1 Coverage					MCV-2 Coverage					SIA Coverage (Nation-wide SIA only)				
	2010	2011	2012	2013	2014	2010	2011	2012	2013	2014	2010	2011	2012	2013	2014
Australia	93.9	94.0	94.0	93.7	93.0	88.4	89.8	91.2	92.2	93.0					
Brunei Darussalam	94.4	91	99	96	97	93	93	96	92	96					
Cambodia	92.7	93	93.4	90.2	94			81.8	63.5	73		100		105	
China	99.4	99.6	99.7	99.6	99	99.2	99.5	99.6	99.6	99	98				
China, Hong Kong SAR	95	95	95	95	95	95	95	95	95	95					
China, Macao SAR		92.8	92.7	98.6	93.3		90.2	89.2	96	90.6					
Japan	94.3	93.6	95.7	95.3	97.5	96.5	92.3	92.2	92.8	93.7	ND				
Lao PDR	64	68.6	71.7	82	87							97			100
Malaysia	95	95.2	85.7	96.6	93.4	95		98.6	99.1						
Mongolia	96.9	98.1	98.8	97.1	98.3	94.9	98.3	98.3	96.7	98.1			93		
New Zealand	91.3	93.3	92.4	92.4	93		86.2	85.5	85.8	86					
Papua New Guinea	59	60	67	70	65						84		88		
Philippines	80	79	85	90	88	10	28	38	53	64		84			91
Republic of Korea	98	99.2	99.4	99.6	100	98.4	98.3	97	95	96					
Singapore	95.1	95	95.1			93.9	94	95							
Viet Nam	97.8	96.5	96.4	97.7	97	97.7	92.8	83.2	85.8	94	96				ND
PICs	75	79	84	87		74	78	84	91		VUT (78)		SLB (102)	VUT (102)	FSM (87) SLB (93)

ND: no data
Source: WHO/UNICEF Joint Reporting Form (JRF) on Immunization

2. Vaccination with RCV in the WPR



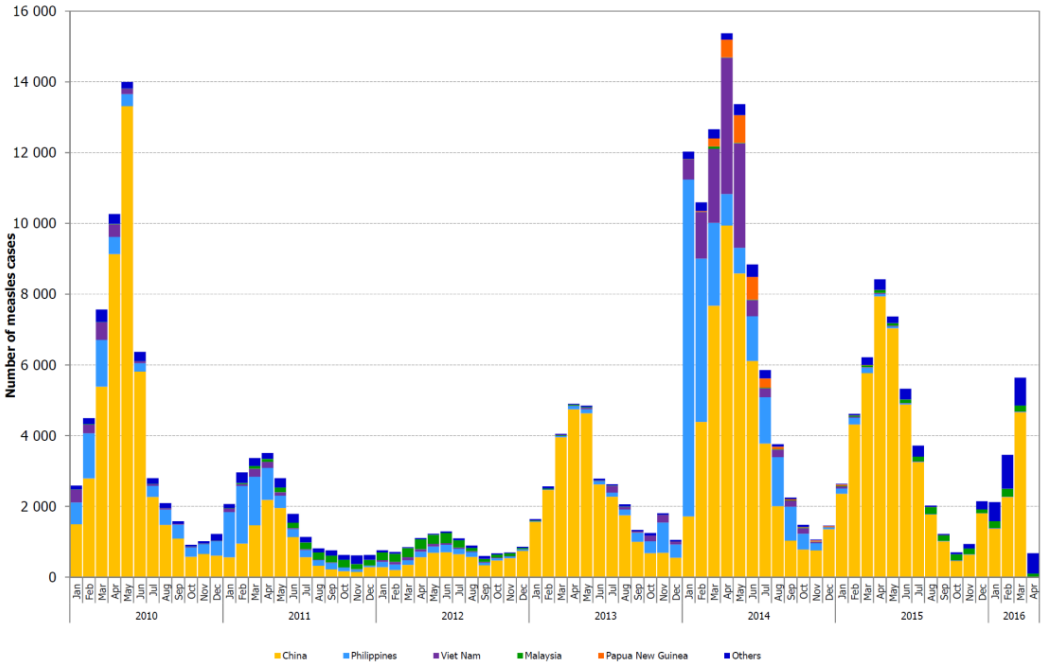
Country	Introduction of RCV into National Immunization Programme			
	RCV-1	RCV-2	RCV-SIA	Birth Cohorts vaccinated with RCV
China	2008 (MR for 8m)	2008 (MMR for 18-24m)		
MOG	2009 (MMR for 9m)	2009 (MMR for 2y)	2012 (MR for 3y-14y)	1998-
LAO	2013 (MR for 9m)		2011 (MR for 9m-19y) 2014 (MR for 9m-59m)	1992-
KHM	2014 (MR for 9m)		2013 (MR for 9m-15y)	1998-
PHL	2010 (MMR for 12m)		2011 (MR for 9m-9y) 2014 (MR for 9m-59m)	2002-
SOL	2013 (MR for 9m)		2015 (MR for 9m-14y)	2001-
VNM	2015 (MR for 18m)		2014-2015 (MR for 9m-14y)	2000-
PNG	2016 (MR for 9m)	2016 (MR for 18m)	2015 (MR for 9m-14y)	2001-

- Among countries that have recently introduced RCV into the national program, China and Mongolia provide rubella vaccine in combination with both doses of measles vaccine; Lao People's Democratic Republic and Solomon Islands provide rubella vaccine with measles vaccines, but have not yet introduced the routine second dose of measles vaccine; Cambodia provides rubella vaccines with the first dose (as MR), but provides single antigen MMR), but uses single antigen measles vaccine for the first dose (now both of Cambodia and the Philippines are in process to be changed).
- In 2008-2013, five non-PICs carried out MR-SIAs: Japan in 2008-2012 targeting birth cohorts born in 1990-1999; the Lao People's Democratic Republic in 2011 targeting birth cohorts born in 1992-2010; the Philippines in 2011 targeting birth cohorts born in 2002-2010; Mongolia in 2012 targeting birth cohorts born in 1998-2009; and Cambodia in 2013 targeting birth cohorts born in 1999-2012 (Table 6).
- In 2014-2015, three non-PICs carried out MR-SIAs: Lao People's Democratic Republic and the Philippines in 2014 targeting birth cohorts born in 2004-2013 and 2009-2013, respectively; Viet Nam in 2014-2015 targeting birth cohorts born in 2000-2013; and in 2015, Papua New Guinea will carry out MR-SIAs targeting birth cohorts born in 2000-2014.

3. Measles Outbreaks and Resurgence in 2013-2015

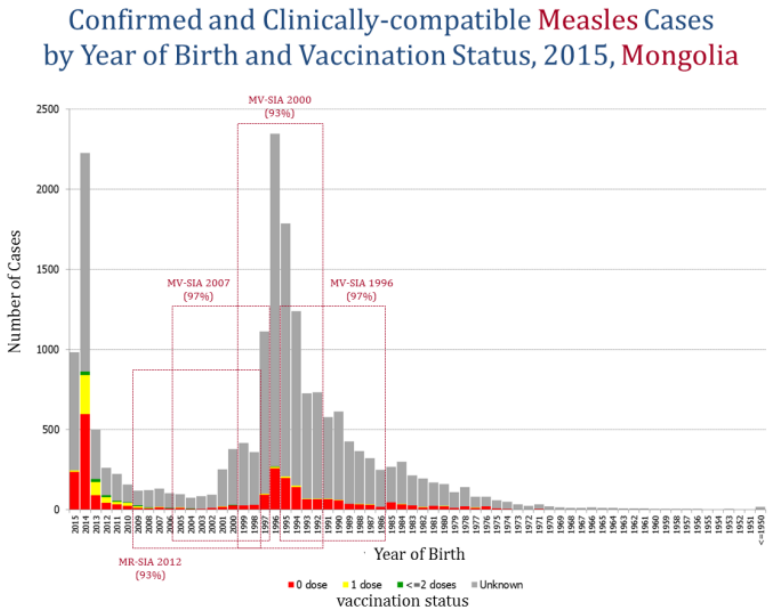
- Regional measles incidence (per 1 million population) has continued to increase from 5.9 in 2012 to 17.7 in 2013, 48.3 in 2014 and 32.0 in 2015, which can be attributed to (i) resurgence of endemic transmission in endemic countries, (ii) large-scale outbreaks following importation in countries with low or no documented transmission for a certain period, and (iii) multiple importations resulting in increased measles incidence in countries having achieved or approached to interruption of endemic measles virus transmission.

Measles cases by month of onset, WHO Western Pacific Region, 2008-2016

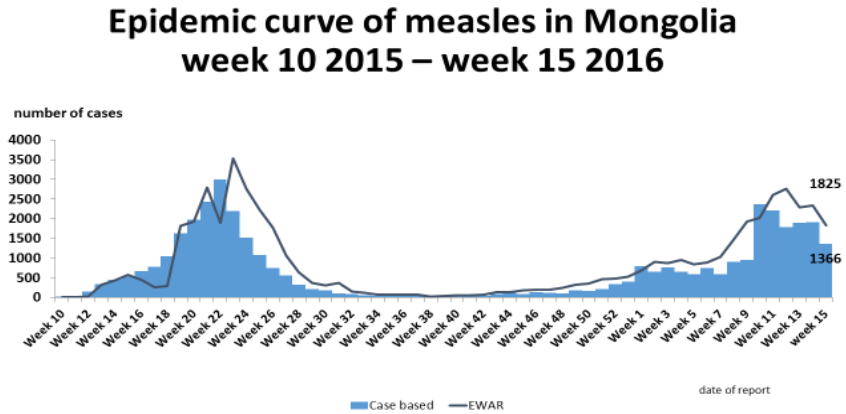


Source: Measles and rubella monthly country reports to WHO by 20 May 2016
Includes laboratory confirmed, epi-linked and clinically confirmed cases for 2010–2012

- Resurgence of endemic transmission: China (H1) and the Philippines (B3 has become endemic since early 2013 while D9, which was endemic in 2010 to 2012, has been not detected since early 2013). Measles transmission has been sustained in the middle and southern parts of Philippines (i.e. Visayas and Mindanao) in 2015 even after the MR-SIA was conducted in September 2014 – See China and Philippines cases studies
- Large-scale outbreaks following importation after a certain period of low or no documented transmission: Viet Nam (due to H1, D8 and B3 in 2013-2014), Papua New Guinea (due to D8 imported from Indonesia in 2013 and B3 imported from the Philippines in 2014), Federal States of Micronesia (due to H1 in 2014), Solomon Islands (due to B3 imported from Papua New Guinea in 2014), Lao People's Democratic Republic (due to H1 in 2014) and Mongolia (due to H1 in 2015).
- With reported >95% coverage with two doses of measles-containing vaccine (MCV) in the routine program for more than 10 years, 93%-97% with SIAs in 1996, 2000, 2007 and 2012, and since 2011 no evidence of sustained measles virus transmission with good quality measles surveillance, Mongolia was considered, in March 2014, having achieved measles elimination status. However in March 2015, multiple laboratory-confirmed measles cases were detected which resulted in the notification of over 20,000 cases from all provinces with 71% of the cases reported from ≥15 years of age and 15% <1 year of age of which 87% were from infants aged < 9 month, not eligible for routine vaccination. The main cause of the outbreak was that routine vaccination coverage figures were in reality lower than the administratively reported ones resulting in accumulation of susceptibles in 9m-5yrs pre-school children and also the fact that for over 14 years very low measles incidence was reported.



MOH responded early in the epidemic with a nationwide < 5 campaign. Due to summer school break and migration from the capital city, case count decreased but with winter and school resuming, the outbreak continued with intense transmission expanding to more Provinces.



- Multiple importations resulting in increased measles incidence (but not in large-scale outbreaks): Australia, Hong Kong, Japan, New Zealand, the Republic of Korea and Singapore. For 2016 up to week 12, 52 measles death have been reported of which 50

4. Population Immunity vs. Vaccination Coverage

- When the regional measles elimination initiative was launched, countries in the Western Pacific Region were required to **achieve >95% population immunity of each birth cohort**:
- But, recently, only **achieving >95% vaccination coverage with two doses of MCV** has been stressed and was replaced as immunization strategies instead of "achieving and maintain 95% population immunity in each birth cohort within each district"
- **Only achieving >95% vaccination coverage with two doses of MCV cannot achieve and maintain 95% population immunity in each birth cohort within each.** In some countries, data quality on cases and coverage will be too poor to enable modelling of the immunity profile. It has become more apparent by the recent measles outbreaks in several countries e.g. CHN,

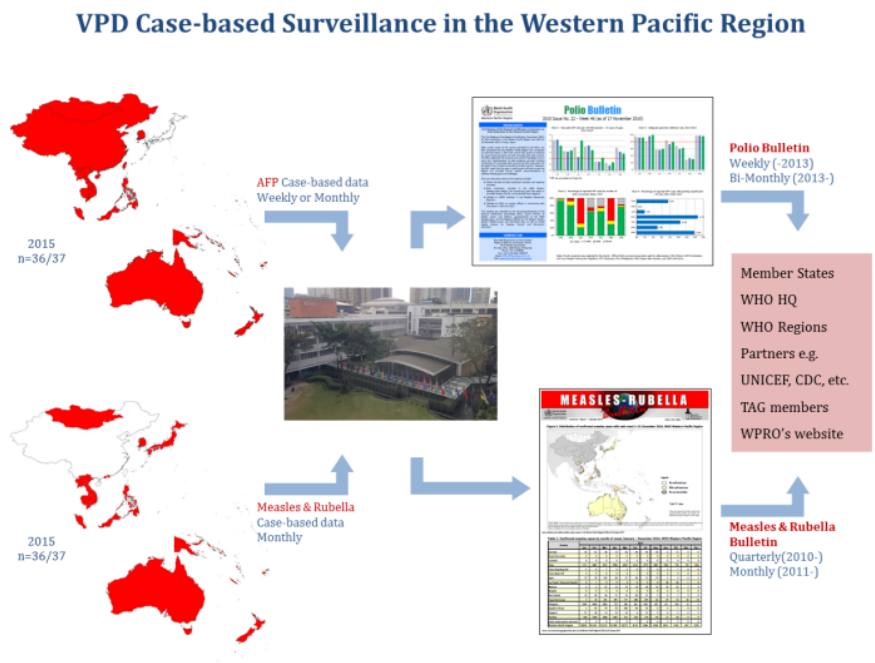
MNG, VNM, etc. that the significant gap exists between "vaccination coverage" or "immunity profile developed based on the reported vaccination coverage" and actual population immunity.

b. Monitor disease using effective surveillance

Measles and rubella surveillance indicators

Indicator	2013	2014	2015
Discarded non-measles rate[1]	3.6	4.2	3.9
% second level units with ≥ 2 discarded cases[1]	40.9%	52.0%	47.7%
% suspected cases with adequate investigation	91.6%	28.2%	79.4%
% suspected cases with adequate blood specimens	89.9%	84.2%	74.3%
% serology lab results ≤ 4 days of receipt	66.3%	31.3%	83.6%
% serology lab results ≤ 7 days of receipt	84.2%	40.7%	91.8%

[1] Per 100 000 population



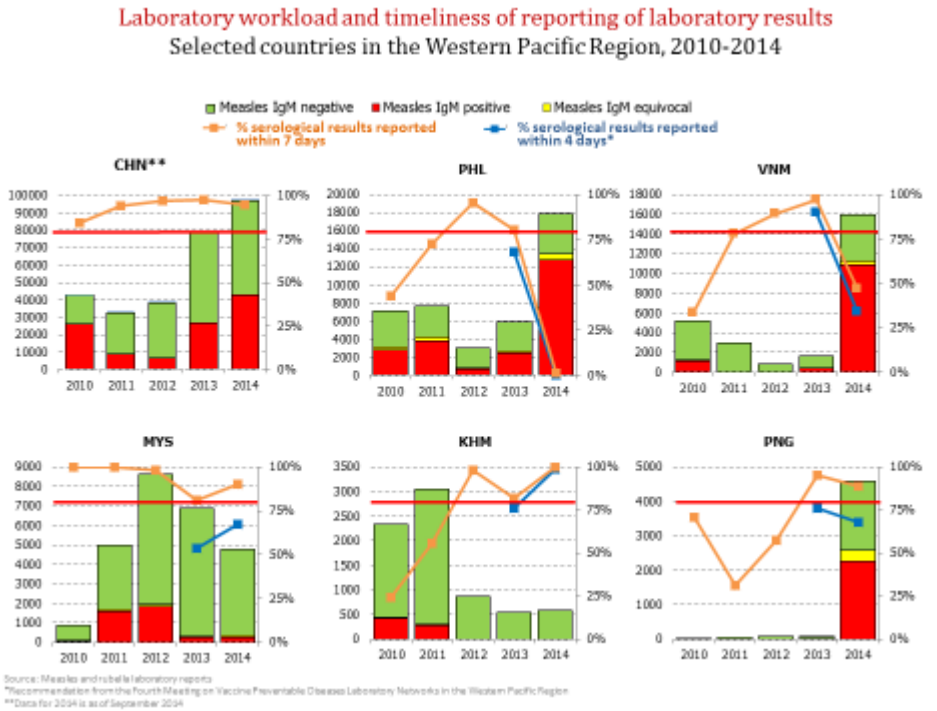
- The Regional Verification Commission (RVC) for Measles Elimination in the Western Pacific confirmed in March 2015 that Australia, Brunei Darussalam, Cambodia, Japan, Macao SAR (China), Mongolia and the Republic of Korea had achieved and sustained verification-standard epidemiological surveillance system supported by accredited laboratories.
- Both (i) reporting rate of discarded measles cases at national level per 100 000 population and (ii) proportion of the second administrative level units reporting at least two discarded measles cases continued to improve in many countries recently. Particularly, the reporting rate of discarded measles cases at national level per 100 000 population has gone beyond the target in all priority countries in the Region in 2014.
- Both (iii) the proportion of suspected measles cases with adequate investigation and (iv) the proportion of suspected measles cases with adequate blood specimens continued to improve in many countries recently while the proportion of suspected measles cases with adequate investigation in several priority countries should be further improved.

Performance of Epidemiologic Surveillance by Country in the WPR, 2010-2014

Country	Reporting rate of discarded measles cases at national level (per 100K population) Target: ≥2					% second administrative level units reporting >2 discarded cases Target: ≥80%					% suspected cases with adequate investigation Target: ≥80%					% suspected cases with adequate blood specimens Target: ≥80%				
	2010	2011	2012	2013	2014	2010	2011	2012	2013	2014	2010	2011	2012	2013	2014	2010	2011	2012	2013	2014
Australia *	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI
Brunei Darussalam *	1.8	1.5	1.5	3.8	3.5	0.0%	0.0%	0.0%	100.0%	100.0%	85.7%	60.0%	71.4%	87.5%	93.8%	100.0%	90.0%	85.7%	100.0%	100.0%
Cambodia *	17.1	20.2	6.8	3.7	4.3	62.5%	70.8%	62.5%	45.8%	83.3%	47.9%	28.5%	56.1%	68.5%	68.9%	98.8%	91.8%	99.2%	98.0%	99.4%
China	1.39	1.84	2.34	3.74	4.7	51.6%	71.0%	71.0%	67.8%	74.2%	88.9%	93.3%	98.3%	98.5%	98.8%	76.6%	90.4%	97.3%	97.3%	96.2%
China, Hong Kong SAR	0.2	3.1	2.5	2.5	2.1	0.0%	100.0%	100.0%	100.0%	100.0%	64.7%	98.2%	92.0%	94.2%	100.0%	88.2%	99.1%	97.3%	91.1%	93.7%
China, Macao SAR *	5.2	2.7	3.9	2.9	2.7	100.0%	100.0%	100.0%	100.0%	100.0%	71.4%	100.0%	95.7%	95.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Japan *	0.0	0.3	0.1	0.7	0.5	0.0%	0.0%	0.0%	4.3%	0.0%	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI
Lao PDR	2.9	5.2	7.6	7.5	4.1	23.5%	52.9%	64.7%	58.8%	58.8%	33.0%	29.3%	49.1%	36.1%	74.5%	42.7%	53.8%	76.6%	66.5%	74.9%
Malaysia	3.6	11.6	20.2	22.6	12.4	50.0%	93.8%	93.8%	100.0%	93.8%	38.7%	46.2%	73.0%	82.3%	73.6%	82.6%	84.5%	81.1%	81.1%	91.5%
Mongolia *	5.6	6.5	22	7.4	4.7	27.3%	13.6%	31.8%	36.4%	31.8%	58.4%	59.6%	64.2%	100.0%	100.0%	96.1%	100.0%	100.0%	100.0%	100.0%
New Zealand	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI	DI
Papua New Guinea	0.4	0.6	0.6	1.4	27.4	5.0%	15.0%	10.0%	25.0%	75.0%	46.2%	40.0%	61.9%	0.0%	0.0%	100.0%	82.0%	81.0%	76.3%	63.8%
Philippines	4.3	3.1	2.1	3.3	3.3	94.1%	88.2%	70.6%	64.7%	58.8%	40.6%	88.6%	57.1%	46.1%	52.5%	87.1%	98.0%	80.4%	63.2%	82.0%
Republic of Korea *	0.3	0.3	0.3	0.8	2.4	0.0%	0.0%	0.0%	6.3%	43.8%	34.8%	64.3%	84.0%	63.7%	95.6%	78.0%	87.1%	90.4%	72.9%	63.3%
Singapore	DI	DI	DI	1.3	1.6	DI	DI	DI	0.0%	0.0%	DI	DI	DI	75.4%	82.8%	DI	DI	DI	18.1%	25.4%
Viet Nam	3.3	16.0	0.9	1.2	3.2	42.2%	71.9%	12.5%	21.9%	40.6%	43.4%	20.0%	44.3%	49.2%	43.5%	71.3%	33.3%	55.0%	63.9%	82.0%
PICs	1.5	17.0	5.6	2.0	3.8	13.0%	17.0%	DI	DI	DI	0.0%	0.0%	0.0%	0.0%	0.0%	DI	DI	DI	DI	DI

DI: Data is insufficient. * RVC confimed that verification-standard surveillance had been estabilised
Source: National measles and rubella monthly reports as of 20 February 2015

- Highly proficient laboratory network with strong quality assurance provided laboratory confirmation and genotyping evidence to the program.
- A new target indicator of timeliness of reporting (80% within four days) has been implemented since 2013. Most of laboratories have achieved this new target recently. However, some countries with large measles outbreaks have struggled to meet this new indicator.



- Both the proportion of laboratory-confirmed cases and the proportion of genotyped cases have continued to improve in many countries.

- For the countries that have verified measles elimination, genotype evidence supports the interruption of endemic measles virus transmission.
- H1, B3, D8 and D9 were the prevalent genotypes detected in the Region's Member States from 2010 to 2014.

c. Develop and maintain outbreak preparedness, respond rapidly to outbreaks and manage cases;

- Outbreak response immunization (ORI) was carried out in 2013 and 2014 in countries affected by measles outbreaks: Viet Nam (from middle 2013 to early 2014, targeting affected communes then enhancing routine immunization programs nationwide); Papua New Guinea (from late 2013 to early 2014, province by province); Philippines (January-February 2014, targeting three provinces); Federal States of Micronesia (2014); Solomon Islands (September to December 2014, nationwide); Lao People's Democratic Republic (July and September to October 2014, targeting affected villages and districts);and Mongolia (May 2015, nationwide).

Summary on Outbreaks and Outbreak Response, 2013-2014

Country	Outbreaks	Response
Viet Nam	• North: Started in early 2013 from several provinces (genotype H1) • South: started in Sept 2013 (genotype D8)	• 190, 464 children without vaccination history at high-risk age were vaccinated in Lai Cai, Yen Bai, Tuyen Quang, Son La, and Ha Giang Provinces in 2013 • 710,000 children vaccinated in March to April 2014 in all of 63 provinces in Viet Nam
Philippines	• Started in early 2013 from NCR, Region 4A, etc. (genotype B3) • Became nation-wide in late 2013	• Catch-up Measles Vaccination in Jan-Feb 2014 targeting 2.2 million children aged 6-36 m in Metro Manila and 7 provinces of Regions 3 and 4A
Papua New Guinea	• Western: Started in Oct 2013 from West Sepik (genotype D9) • Others: started in early 2014 from Port Moresby (genotype B3)	• A province-wide non-selective measles vaccination of children between 6 months to 5 years in West Sepik in Nov-Dec 2013 • A province-wide non-selective measles vaccination of children between 6 months to 20 years in National Capital District in April 2013 • Other provinces affected also conducted province-wide mass vaccination
Micronesia		
Solomon Islands	• Started in July 2014 from Honiara City with an index case returning from PNG	• Mass vaccination campaign targeting people aged 6 months to 30 years started in September 2014 from Honiara City followed by the entire Guadalcanal Island
Lao PDR	• Brorikhamsay in June 2014 • Huaphanh & Brorikhamsay in September 2014	• Outbreak response immunization targeting 9 m-14 y in the village affected in Brorikhamsay in July 2014 • Outbreak response immunization targeting 6 m-20 y in 3 districts affected in Huaphanh in Oct 2014

d. Communicate and engage to build public confidence and demand;

- No substantial progress in this area in the Western Pacific

e. Research and development to support cost-effective operations and improve vaccination and diagnostic tools.

- Region is unaware of activities related to this topic in the region.

6.5 Successes and failures in applying the 4 "Guiding Principles"

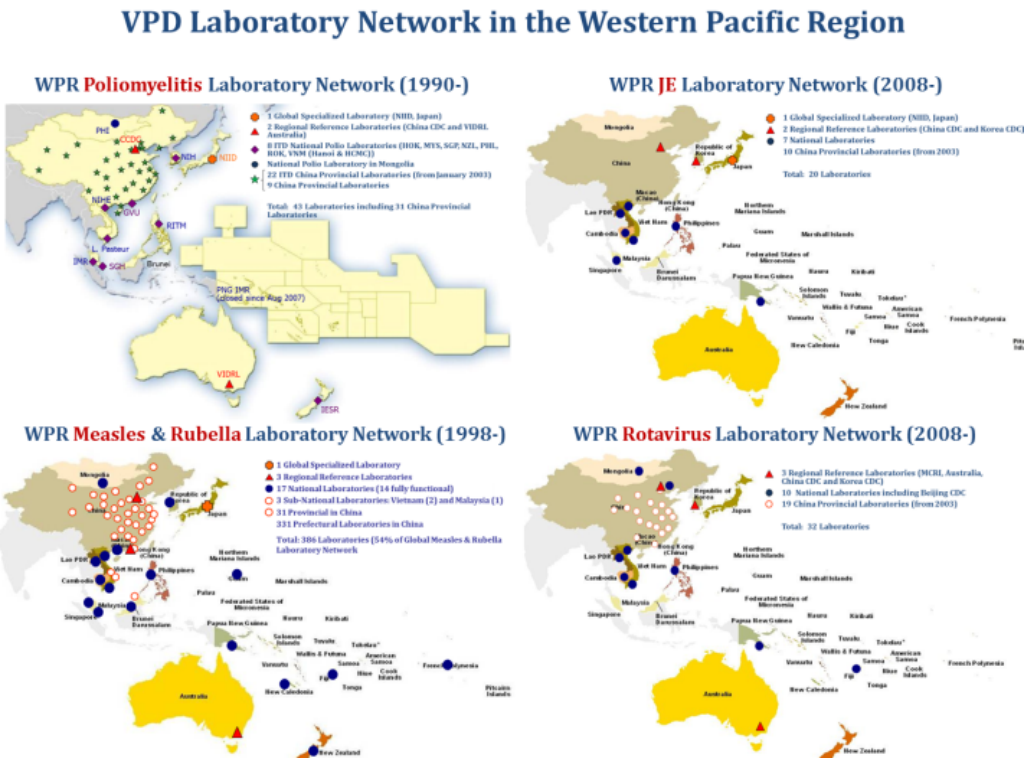
a. Country ownership & sustainability

- cMYPs were developed by Gavi-supported countries only in the Region (KHM, KIR, LAO, MNG, PNG, SLB and VNM) in 2006-2015 mainly for applying Gavi's funding support. PHL became the first non-Gavi-supported country that developed cMYP in 2015.

- Most countries and areas in the region have already achieved middle- or high-income designation. Although Lao PDR and Solomon Islands remain eligible to apply for financial support in 2016, by perhaps as early as 2018, Cambodia may be the only country in the region that remains "Gavi-eligible" as a low income country. As such, countries are taking on more responsibility in covering costs of routine and supplemental immunization programs including measles and rubella.
- There are several countries in the Region that have not yet strongly committed themselves to mobilize the resources required to ensure the highest quality immunization services, which has resulted that Immunization, whether through routine services or SIAs, have not yet reached all children with two doses of measles and rubella-containing vaccine leaving significant gaps due to geography, religion, ethnicity, or socioeconomic status.
- While the Regional Committee of WHO for the Western Pacific every year from 1988 to 2000 had the Regional Polio Eradication on its agenda, developed regional resolutions and urged Member States to strengthen and maintain commitment, take concrete actions for the Regional Polio Eradication (13 resolutions in 12 years after launching the Regional Polio Eradication), it put Regional Measles Elimination on its agenda in 2003, 2005, 2010 and 2012 - only 4 resolutions in 13 years after launching Regional Measles Elimination in 2003.

b. Routine immunization and health system strengthening

- Overall, the Regional and Member States made substantial progress in developing, conducting SIAs, disease surveillance, monitoring and an integrated laboratory network.



- However, some counties in the Region have not yet taken sufficient responsibility for providing the resources necessary to strengthen immunization systems, including high-quality routine immunization programs and SIAs (e.g. LAO, PHL, PNG, VNM)

- Together with introduction of RED Strategies, efforts for strengthening routine immunization program and conducting SIA to eliminate measles have provided an opportunity strengthen health systems (e.g. health service delivery, injection safety, capacity building for sub-national staff, etc. in KHM, LAO, MNG, PHL, PNG, etc.)

c. Equity

- Disease elimination is one of the few programs that can claim 100% equity. In seven countries and areas that have eliminated measles to prevent any transmission, all persons were protected from measles disease.
- It has been not yet sufficiently addressed that substantial population in several countries have not yet fully benefited from disease-prevention programs, vaccination and protection against measles and rubella e.g.: Hmong minority groups in Lao PDR and the northern part of Viet Nam, adolescent and young adults in Visaya and Mindanao in the Philippines, migrants between Viet Nam and Cambodia, urban slum dwellers in the Philippines, etc.)

d. Linkages (e.g., polio eradication)

- In most countries/areas measles/rubella case based surveillance was developed on the platform of AFP surveillance and is included in an integrated vaccine preventable diseases surveillance system.
- As per Table 1, question 9, other intervention were included in 2014-2015 SIAs in Lao, Philippines, Papua New Guinea, and Vanuatu.

6.6 Success factors enabling progress

- Country commitment and ownership enhanced by the World Health Assembly and the Regional Committee (see the 4th bullets in the 4-a).
- Updated regional strategies and plan of action to guide Member States in developing and implementing appropriate strategies with full consideration of country-specific conditions.
- Bilateral collaboration in the Region. While Japan was very active in providing technical and financial support to several priories countries (e.g. CHN, LAO, KHM, PHL, PICs, VNM, etc.) in the Regional Polio Eradication in 1990s, there is no country that actively engage itself to provide support to priority countries in the Regional Measles Elimination. In 1990s, the Regional Committee of WHO in the Western Pacific always expressed its appreciation and request to international partners for continuous support to the Regional Polio Eradication while it did not do for the Regional Measles Elimination.
- Global/regional elimination targets have provided incentive for countries;
- The regional verification of measles elimination is seen as important target by disease control programs. There are several examples where the verification of one country or area pushed another to work hard to fulfil the criteria and submit a report requesting verification.

6.7 Barriers to achieving the targets

- Repeated resurgence of measles in endemic countries (China, the Philippines and Viet Nam)
- Increased infection and transmission of measles virus among people out of the target of current immunization strategies for measles elimination (i.e. infants aged <8 months, adolescents and

adults) (e.g. several provinces in China, several regions in the Philippines, recent measles outbreaks in Solomon Islands, Mongolia, etc.)

- Importation-induced large-scale measles outbreaks in countries with residual or accumulated immunity gaps (e.g. Lao People's Democratic Republic, Mongolia, Papua New Guinea, Solomon Islands, Viet Nam, etc.)
- Insufficient country commitment and ownership in several priority countries e.g. CHN, MYS, PHL, VNM
- An important barrier is the human resource and financial costs of conducting intermittent SIAs in countries that still require this intervention in order to prevent cyclical outbreaks. The recently revised Gavi strategy may help some, but since most countries have or will soon be graduating, this financial support will not be a resource for several important countries that have not yet achieved elimination.
- De-centralization and lack of commitment to the regional goal of elimination at the state or provincial level remains a barrier. There are many good examples where commitment is high, but there are also many examples of lack of political will / interest in measles elimination at lower levels.

6.8 Conclusions

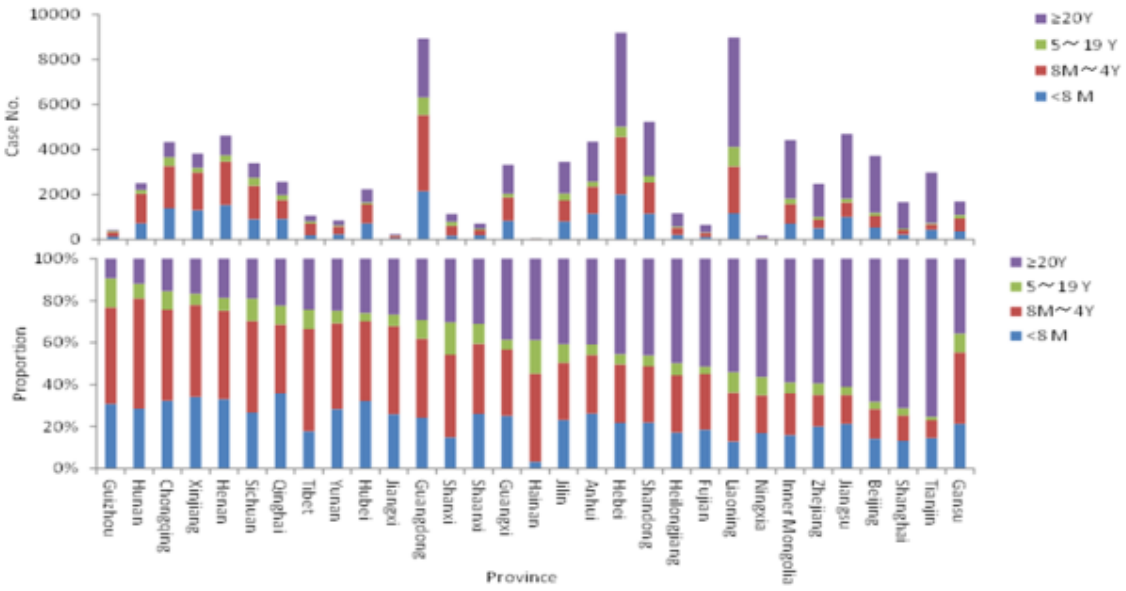
- Strong regional commitment
- 7 counties (Australia, Macao (China), Mongolia and Republic of Korea in March 2014, and Cambodia, Brunei Darussalam and Japan in March 2015) were verified by the Regional Verification Commission in 2014-2015 to have interrupted endemic measles virus transmission for more than 36 months.
- High MCV1&2 and MCV-SIAs coverage
- Lowest rate 2012
- Good case base and lab surveillance

But

- Reliance on “reported coverage” over estimating real coverage and underestimating number of susceptible.
- Follow-up SIA, usual too late and with not a large enough age group
- Good case-base and laboratory surveillance system (Case base surveillance building up in China) but usually early case detection is not aggressive enough and detail analysis of measles outbreaks and reason of resurgence is delayed hampering control and prevention measures.
- No control in Malaysia
- Large Scale outbreaks following importation in VTN, PNG, SOL, and Mongolia this last country will be considered as re-established transmission with more than 1 year since 1st case
- Increased infection and transmission of measles virus among people outside the target of current immunization strategies i.e. infants aged $\leq$8 months, adolescents and adults.

- Within large countries, age specific attack rate can vary complicating the determination of optimal target population for SIAs and necessitating specific approaches fitting Provincial/Regional measles epidemiology as illustrated is the below graph from China.

Variation of Measles Case Age Group Distribution by Provinces, China 2015



- At the difference of polio, there is no major donor to the program and as region is developing fast, less and less countries can avail from GAVI funding which necessitate more and more funding from national government. This lack of funding affect timing of SIAs and outbreak response organization.

- In case of an outbreak, health services not fully implementing infection control measures to prevent nosocomial transmission of measles.

6.9 Country Case Studies

Kingdom of Cambodia

Demographics

Cambodia is a country located in the southern portion of the Indochina Peninsula in Southeast Asia. Its total landmass is 181,035 square kilometers (69,898 sq mile), bordered by Thailand to the northwest, Laos to the northeast, Vietnam to the east, and the Gulf of Thailand to the southwest.

Total population in Cambodia for 2016 is 14,884,864. Of the total population, 4,446,268 are < 15 years of age, 1,553121 are < 5 years of age and 343,840 are < 1 year of age.

The population is concentrated between Phnom Penh and the border with Viet Nam, and around the Tonle Sap River. The proportion of the population living in rural areas is 80.5 percent, whereas, 19.5 percent of the country's residents live in urban areas. There is significant border traffic both with Thailand (migrant labour and trade) and Viet Nam (trade) and to a lesser extend with Laos. There is also an increasing movement of people, especially from the ethnic Cham community, to Malaysia to work as domestic helpers and maids.

In 1994, the Ministry of Health, as part of health sector reform, created the Operational Districts (ODs) for providing health services different from the administrative districts. The public health system is overseen by the Ministry of Health (MOH) and operates at four levels: national, provincial, operational district and health centre. MOH supervises the work of 25 provincial health departments (PHDs), 91 Operational Districts (ODs), 1,106 health centres (HCs) and 112 health posts. ODs can comprise more than one administrative district. HCs serve an average of 10-12 villages, normally within one administrative commune. There are 91 referral hospitals (RHs) at district and provincial levels, classified into 3 categories depending on the level of service provided. There are also 8 national level hospitals. In the private sector, there were 1,795 licensed medical facilities in 2013, mostly small clinics, but including 8 private hospitals and 48 polyclinics. All private facilities that had applied for registration were licensed by MOH.

The Ministry of Health of the Kingdom of Cambodia made very strong progress in reducing child deaths. The infant mortality rate is 28 per 1,000 live births, a major reduction from 95/1,000 in 2000. Child mortality (for those aged 1 to 5 years) is 7/1,000, down from 33/1,000 in 2000. That means that the overall mortality rate for children under 5 years of age is now 35/1,000, compared to 124/1,000 in 2000. Immunization with measles and other antigen has made an important contribution to these improvements.

Summary of progress towards measles/rubella targets as of 2015

The National Immunization Program (NIP) of Cambodia began in 1986, and expanded to all provinces by 1988. In 1994, the Ministry of Health (MOH) established a polio eradication team to focus efforts

in this area, and Cambodia joined the rest of WHO's Western Pacific Region in being certified polio free in 2000.

Following the NIP's success with polio elimination, attention was turned to reducing the burden of measles, and maternal and neonatal tetanus, primarily through expanding the reach of routine immunization services (fixed site, outreach) and conducting measles and tetanus toxoid campaigns. MOH set national goal for measles elimination in 2006 and developed a National Measles Elimination Plan in same year.

The NIP conducted nationwide measles immunization catch-up campaign, targeting children aged nine months to 14 years old in four phases from 2000-2004. Moreover, the NIP conducted multi-antigens campaign targeting only in High Risk Areas in 2005. These two activities supported Cambodia towards achieving measles elimination goal. Subsequently, the NIP conducted measles campaign in 2007 and 2011 (please table 1)

Table 1: Reported number/coverage of Measles / MR SIAs from 2004-2013

Measles/MR SIAs coverage	Age group	No of children immunized by MCV	% coverage
2004 measles SIAs(all four phases)	9 - 14 years	362,397	87%
2005 multi-antigen campaign	9-59 months	114,949	86%
2007 measles SIAs	9-59 months	1,526,530	104%
2011 measles SIAs (Round1)	9-59 months	1,504,216	100%
2011 measles SIAs (Round 2)	5-9 years	318,129	For HRCs
2013 MR SIAs	9 months -14 years	4,576,633	105%

Following the recommendation from WHO Regional Office for the Western Pacific, the NIP made further efforts toward measles and rubella elimination. Measles second dose vaccine was introduced in the routine immunization system in 2012. MR vaccine was introduced in routine system (age 9 months) following a campaign in 2013. Furthermore, as WHO advised, the NIP switched from 2nd dose measles vaccine to measles-rubella vaccine in 2015.

At the same time, over the past decades, efforts made to increase the routine coverage for MCV1 and from 2012 for MCV2 (please see table 2). To reach the unreached children, the NIP developed the High Risk Communities Strategies (HRCs). As part of HRCs, 3-4 rounds of outreach immunization services are being conducting since 2014 and coverage for different antigen including measles is high. This also makes NIP to get success in increasing population immunity for measles.

Table 2: Reported MCV1 and MCV2 coverage from 2005-2015

No	PHD name	2015		2014		2013		2012	2011	2010	2009	2008	2007	2006	2005
		MR1	MR2	MR1	MR2	MR1	MR2	M1	M1	M1	M1	M1	M1	M1	M1
1	BANTEAY MEAN CHEY	104	87	102	93	91	76	97	95	92	90	87	68	66	65
2	BATTAMBANG	86	75	86	65	83	71	89	92	87	87	82	79	79	79
3	KAMPONG CHAM	106	82	105	84	126	73	112	106	101	98	99	82	83	81
4	KAMPONG CHHNANG	84	67	80	70	85	76	94	89	91	98	93	75	74	74
5	KAMPONG SPEU	74	50	76	58	77	53	84	79	85	87	85	76	71	72
6	KAMPONG THOM	79	52	87	59	91	56	101	90	87	87	86	72	72	72
7	KAMPOT	93	78	90	86	87	75	91	92	86	86	87	77	67	68
8	KANDAL	100	86	97	87	73	63	92	82	90	97	91	83	85	81
9	KOH KONG	92	55	92	65	79	46	80	80	76	80	80	50	50	52
10	KRATIE	72	51	80	53	75	60	89	74	69	64	60	46	56	50
11	MONDUL KIRI	121	66	125	52	104	30	109	109	77	75	74	77	63	68
12	PHNOM PENH	99	91	84	68	57	39	64	79	93	80	71	72	74	72
13	PREAH VIHEAR	109	58	111	48	169	89	117	100	73	76	75	81	82	81
14	PREY VENG	85	57	83	59	101	59	84	82	97	87	89	77	71	71
15	PURSAT	102	86	91	78	86	66	92	94	89	88	89	73	73	73
16	RATTANAKIRI	86	63	98	81	139	194	158	125	83	82	78	65	68	65
17	SIEM REAP	101	81	100	79	90	60	91	91	88	90	87	90	89	88
18	SIHANOUK	75	50	76	68	66	57	71	81	82	76	70	58	56	56
19	STUNG TRENG	169	114	157	92	104	68	113	93	78	82	81	82	81	80
20	SVAY RIENG	96	78	98	92	101	77	89	91	103	97	96	80	79	77
21	TAKEO	100	89	91	54	98	65	91	92	88	87	85	75	76	75
22	ODOR MEAN CHEY	122	89	131	98	134	96	134	106	84	86	94	147	140	134
23	KEP	93	90	89	97	96	84	79	97	91	103	78	61	78	61
24	PAILIN	72	49	87	61	64	37	58	80	66	70	70	123	90	112
25	TBONG KHMUM	106	86												
Total		98	77	94	73	90	63	93	93	93	92	89	78	78	77

As commonly found administrative figures differ from survey data: the Demographic Health Survey (DHS) conducted in 2014 showed that MCV1 coverage was 78.6 nationally and 81.9% in 2010.

Measles case based surveillance started in 1998. The surveillance system is passive with regular reporting to central NIP. Clinicians, health workers, and health staff, from both public and private health facilities report suspected measles case. Health workers fill out the reporting form for suspected measles cases and submit it to the ODs.

Over the period of time, measles surveillance system strengthened in Cambodia. Quality of surveillance still varies by provinces. Some measles surveillance indicators are still low at sub-national levels (please see table 3). Special efforts were made for strengthening measles surveillance in 2014 and 2015. A team consisted of WHO and NIP visited low performing areas, sensitized and provide on job training. National and sub-national level trainings were conducted and VPD surveillance guideline was updated and in use now. National measles laboratory is also maintaining their high performances in last couple of years.

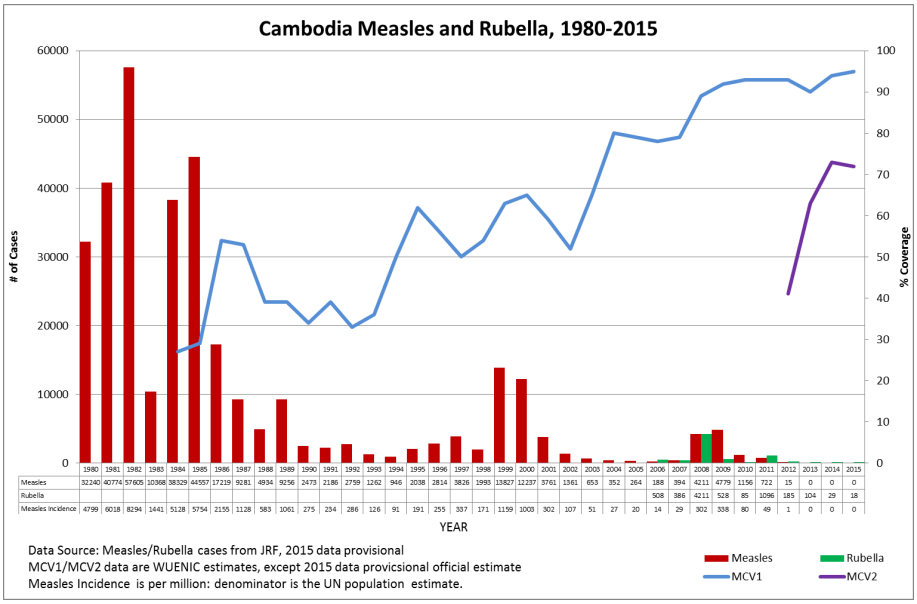


Table 3: Measles-Rubella report by Province, 2011-2015

No	Name of Province	2011			2012			2013			2014			2015		
		Suspected case	Confirmed case		Suspected case	Confirmed case		Suspected case	Confirmed case		Suspected case	Confirmed case		Suspected case	Confirmed case	
			Measles	Rubella		Measles	Rubella		Measles	Rubella		Measles	Rubella		Measles	Rubella
1	Banthey Meanchey	163	16	67	69	0	25	47	0	2	139	0	0	34	0	0
2	Battambang	19	12	1	5	0	0	24	0	2	26	0	2	24	0	0
3	Kampong Cham	270	29	75	73	0	3	95	0	7	41	0	1	51	0	0
4	Kampong Chhang	13	0	1	92	0	2	118	0	3	12	0	3	15	0	1
5	Kampong Speu	211	24	53	130	0	17	5	0	3	29	0	3	21	0	0
6	Kampong Thom	2	0	0	7	0	3	2	0	0	14	0	0	21	0	0
7	Kampot	0	0	0	17	0	0	18	0	17	52	0	1	55	0	0
8	Kandal	132	6	27	54	0	1	71	0	26	41	0	4	30	0	0
9	Koh Kong	18	5	4	15	0	0	18	0	2	3	0	0	8	0	0
10	Kratie	701	109	154	165	0	41	38	0	13	5	0	1	61	0	9
11	Mondul Kiri	13	3	0	5	0	0	1	0	0	9	0	0	8	0	0
12	Phnom Penh	28	1	10	6	0	0	10	0	4	36	0	4	78	0	1
13	Preah Vihear	85	28	3	0	0	0	1	0	0	11	0	1	6	0	0
14	Prey Veng	617	8	53	7	0	1	10	0	3	23	0	0	26	0	3
15	Pursat	130	57	41	10	0	0	13	0	8	10	0	0	7	0	0
16	Rattanak Kiri	192	0	36	7	0	0	45	0	5	49	0	5	63	0	1
17	Siem Reap	51	15	18	30	0	7	8	0	7	30	0	0	38	0	1
18	Preah Sihanouk	0	0	0	0	0	0	1	0	0	9	0	0	7	0	0
19	Steung Treng	14	0	7	13	0	5	1	0	1	4	0	1	9	0	0
20	Svay Reng	61	1	25	182	0	23	0	0	0	25	0	2	16	0	0
21	Takeo	830	1	490	10	0	0	3	0	0	58	0	1	45	0	1
22	Odor Mean Chey	56	5	27	100	0	57	8	0	1	4	0	0	23	0	0
23	Kep	0	0	0	0	0	0	0	0	0	4	0	0	5	0	0
24	Pailin	4	0	0	2	0	0	0	0	0	2	0	0	8	0	0
25	Tbong Khum								-					54	0	1
Total		3,610	320	1,092	999	0	185	537	0	104	636	0	29	713	0	18

On 19 November 2014, as there had been no laboratory confirmed measles case reported in Cambodia since November 2011, the Cambodian National Verification Committee (NVC) for measles headed by Professor Yit Sunnara reviewed all the documents provided by the NIP and concluded that there is strong evidence that endemic measles virus transmission has been interrupted and therefore Cambodia has achieved elimination of endemic measles virus for a period of 36 months and eligible for measles verification process by Regional Verification Commission (RVC).

Regional Verification Commission of WHO Western Pacific Region met in Macao from 24-27 March 2015, reviewed the NVC report and concluded that Cambodia have successfully eliminated endemic measles.

In January 2016, 2 cases of measles have been confirmed from 2 different provinces with very low MCV coverage: MR1 70% and 60% and MR2 37% and 28%. Proper cases investigation has been done with contact tracing. As response, and taking advantage of the planned National JE 9month-14years campaign, MR vaccine will be provided, in 11 highest risk provinces to 9-59 months. In the remaining provinces catch-up MR vaccination targeting children age 9-35 months using the routine stock will be conducted.

Cambodia integrated rubella surveillance into measles surveillance. A total of 18 lab confirmed rubella cases were reported in 2015. Two CRS sentinel sites were established in 2011 for a period of one year and then extended. National Paediatric Hospital was not performing well and however, provincial hospital of Kampong Cham Province has been working and reported some CRS cases. Rubella and CRS surveillance part was updated in VPD guidelines in 2015. Following the RCM resolution in October 2014, NIP adopted the goal of rubella elimination in December 2014 and will develop the strategic document in 2016 and put efforts towards the goal of rubella elimination.

Five key strategies

1) *Has the country achieved and maintained high population immunity through vaccination with 2 doses of M/MR/MMR vaccine?*

Yes, country achieved high population immunity through multiples measles SIAs. In 2015, National

MCV1 and MCV2 coverage is 98 and 77 respectively. However, MCV1 coverage is low less than 90% in 9 provinces. MCV2 coverage is significantly low in most provinces (please see table 3). The Demographic Health Survey (DHS) conducted in 2014 showed that MCV1 coverage is 78.6 nationally, it was 81.9% in the 2010 survey.

2) *Has the country develop an effective disease surveillance system supported by a WHO accredited laboratory?*

Yes, surveillance system already developed from HC to national level and functioning. However, community surveillance is still poor. Moreover, quality of surveillance varies by province (please see table 4). Capacity building activities to detect, report and investigate the case was done in 2014/15.

3) *Has the country been successful in conducting outbreak preparedness and response?*

Yes. Country developed the measles outbreak preparedness and response plan in early 2015 and updated in late 2015 again.

In October 2015, a measles case was confirmed by national lab. Immediately, outbreak response was initiated. However, the case became negative after confirmatory test in WHO RRL. In

January 2016, two confirmed case were reported and responses were taken immediately. However, the preparedness and operations are delayed due to funding issues.

Has the country developed communication strategies to build public confidence in vaccination?

Country developed communication strategies in 2005 and not updated yet. But various IEC materials including two videos on importance of vaccination were developed and in use. There is rare case in vaccine hesitancy in Cambodia.

Has the country implemented innovative strategies or conducted operational research to access previously unreached communities with vaccination services and/or disease surveillance capability?

High Risk Community Strategies is one of the products of operational research and which already in implementation.

What were the critical success factors?

- High level political commitment for measles
- Community awareness about measles and demand for vaccination
- Repeated measles SIAs
- Partners support for measles elimination program
- Introduction of 2nd dose measles vaccine

What were the significant barriers to achieving targets?

- Routine outreach services are stopped for more than a year and no/inadequate funds to conduct it
- No funds for surveillance activities, heavily rely on WHO
- No funds is available for outbreak response and rely on WHO
- Still many children are unvaccinated
- 2014 DHS showed coverage for almost all antigens is declining
- Substantial no of private clinics are not included/aware of measles surveillance

Conclusion

The coverage is declining as per DHS 2014. Moreover, as routine outreach services are not conducted for more than one year, the coverage will further decline. The country can maintain the measles elimination status and achieve rubella elimination if the above barriers can be removed and if in front of new cases, swift outbreak response is done. The Pre-emptive follow-up campaign planned for 2017 should be advanced to 2016 to prevent any sustained transmission.

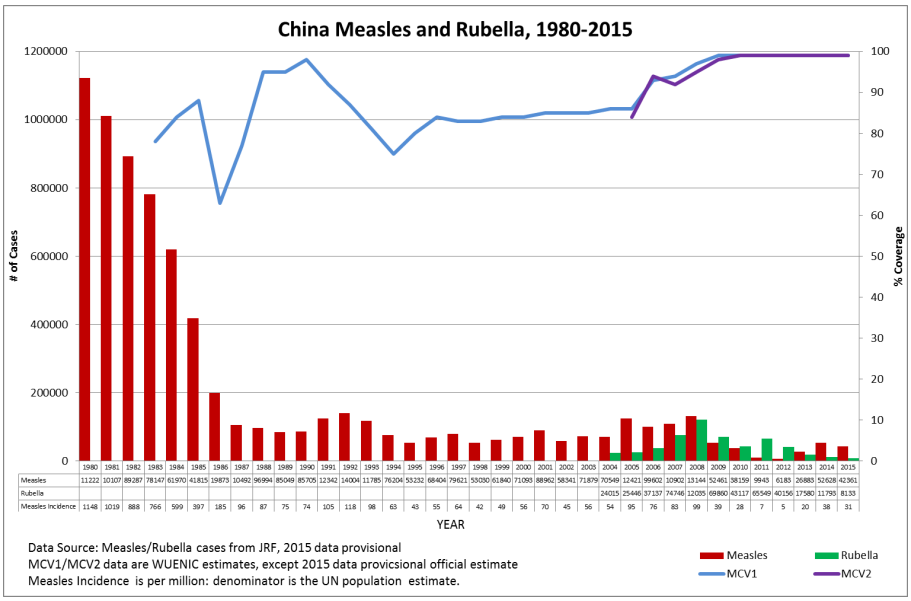
Country Case Study - China

1. Demographics

The People's Republic of China. According to the 2012 China statistical yearbook, China is currently divided into 23 provinces, 5 autonomous regions, 4 municipalities directly under the Central Government and 2 special administrative regions. The number of regions at prefecture level is 332, with 284 cities at prefecture level. The number of regions at the county level is 2853, with 857 districts under the jurisdiction of cities, 369 cities at the county level, 1456 counties, and 117 autonomous counties.

According to the essential statistics on national population census in 2010, the total population was 1.34 billion with 49.7% urban population and 16.6% population under age 14 years old. There are 55 different types of ethnic minorities with the population of 113.79 million, accounting for 8.5% of the total population of China. The birth rate was 11.93‰ in 2011 (China statistical yearbook 2012).

2. Summary of progress towards regional measles/rubella targets as of 2014



China has a goal to eliminate measles by 2012, however, that goal has not been met. China agrees with the goal to eliminate rubella, but has not agreed on a time line for rubella elimination. Progress towards the measles elimination goal is described below.

Before licensure of measles vaccine (MV) in 1965, the annual measles incidence in China fluctuated between 10,000 and 50,000 cases per million population. Establishment of the national Expanded Program on Immunization (EPI) in 1978 enabled a one-dose routine MV schedule, with the dose administered at 8 months of age. In 1986, a 2-dose MV schedule was recommended - one dose at 8 months followed by a second at 7 years of age. The recommended age for the second dose was lowered to 18 months in 2005.

In addition to routine measles vaccination, in 2006 China began closing immunity gaps among children using province-wide, catch-up, supplementary immunization activities (SIAs). These campaigns were followed by a large nationwide SIA in 2010. As of September 2010, every birth

cohort between and including the 1995 and the 2009 cohorts has been targeted with an SIA that vaccinated children regardless of their prior vaccination history [5]. Some provincial SIAs targeted cohorts as early as the 1990 birth cohort.

Continuous use of the 2-dose measles-containing vaccine (MCV) vaccination policy for 25 years, coupled with the comprehensive SIA strategy, has led to a marked decrease in measles, so that by 2012, the annual incidence was at its lowest point ever of 4.6 cases per million population. However, accumulation of susceptible children in new birth cohorts has allowed a resurgence of measles that started at the end of 2012, reaching 19.8 per million in 2013, 35.3 per million in 2014 and 29.5 per million in 2015.

With a greater than 99.5% decrease in the incidence of measles during the elimination effort in China, the age distribution of measles case-patients has changed. In recent years, relatively few cases have been reported from age-groups that were targeted by SIAs. Instead, the majority of cases have been occurring among young children <24 months of age and adults. Among all reported measles cases, the percentage of cases in the over 15 year old age group was less than 10% in the early 1990s, increased to 27% in the first ten months of 2013, and further increased to over 40% in 2014. Some provinces have been having measles outbreaks among adults.

In 2014, China confirmed 52,628 measles cases, with 48,123 of these cases either laboratory confirmed or epi-linked cases (Figure 1). The resurgence of measles occurred in most areas of China in 2014 (Figure 2). The H1 genotype remains the predominant genotype that has been circulating in China.

In 2014, the proportion of adult cases increased remarkably, especially in eastern areas (Figure 3). In 2014, 43% of cases were ≥20 years compared to 25% in 2013. In general, few cases were among school-age children, and most of the cases among young children were among infants too young to vaccinate. Additionally, the age-distribution of measles case is considerably different in different provinces: 20 years and above adult cases accounted for >60% of cases in Tianjin, Beijing, Shanghai, Inner Mongolia, Zhejiang, and Liaoning with in most central and western provinces where children ≤ 1year old accounted for >60% of cases.

In 2015, there were 42,361 cases and 33 measles-caused deaths in China, *provisional data*.

Based on the profile of measles epidemiology, the China's NHFPC re-emphasized that routine immunization remains the foundation of measles elimination. In most outbreak areas, SIA were conducted with varying target-age groups. The China CDC also issued national guideline on measles outbreak response in 2013 and held a series of workshop or training course for local CDC professionals. The updated measles surveillance guidelines and system switched from measles surveillance separate from rubella surveillance to an integrated measles and rubella surveillance system in 2014.

Figure 1. Measles Cases by Month and Year, China, 2007 – May 2015

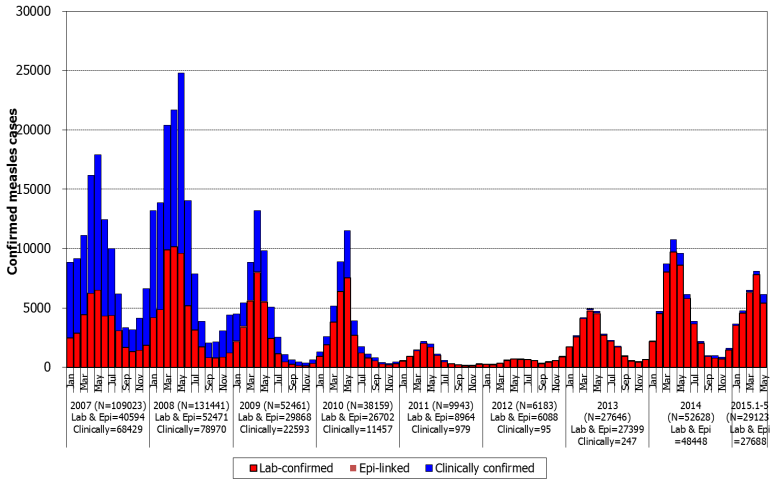
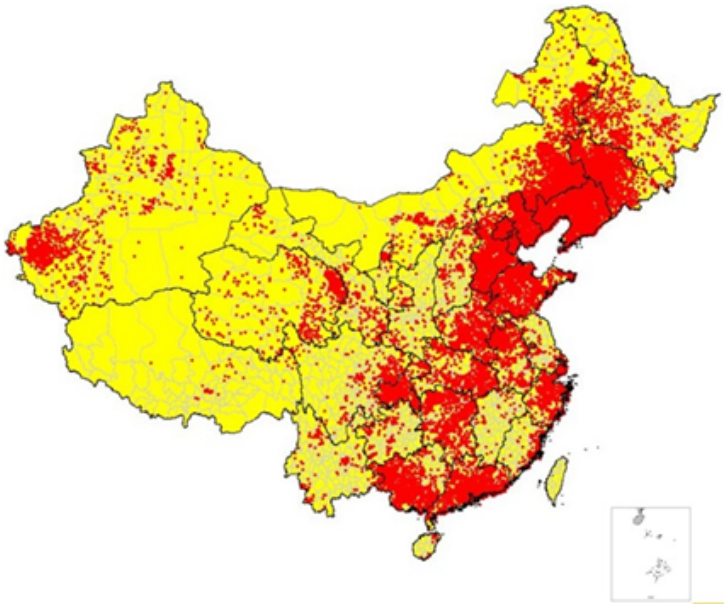
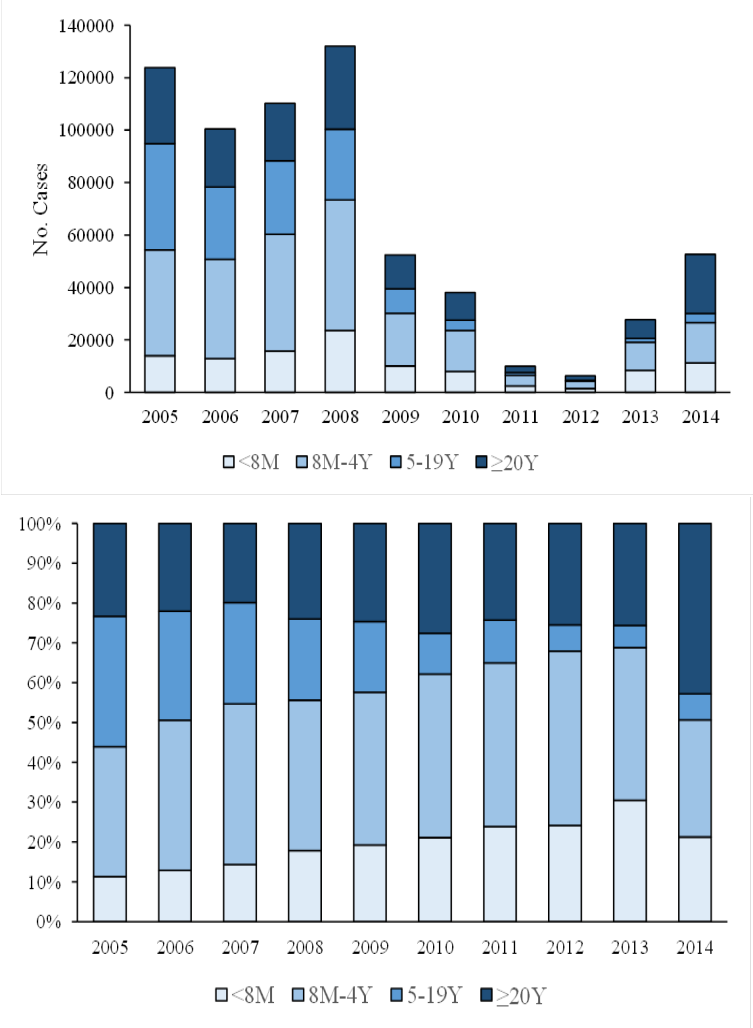


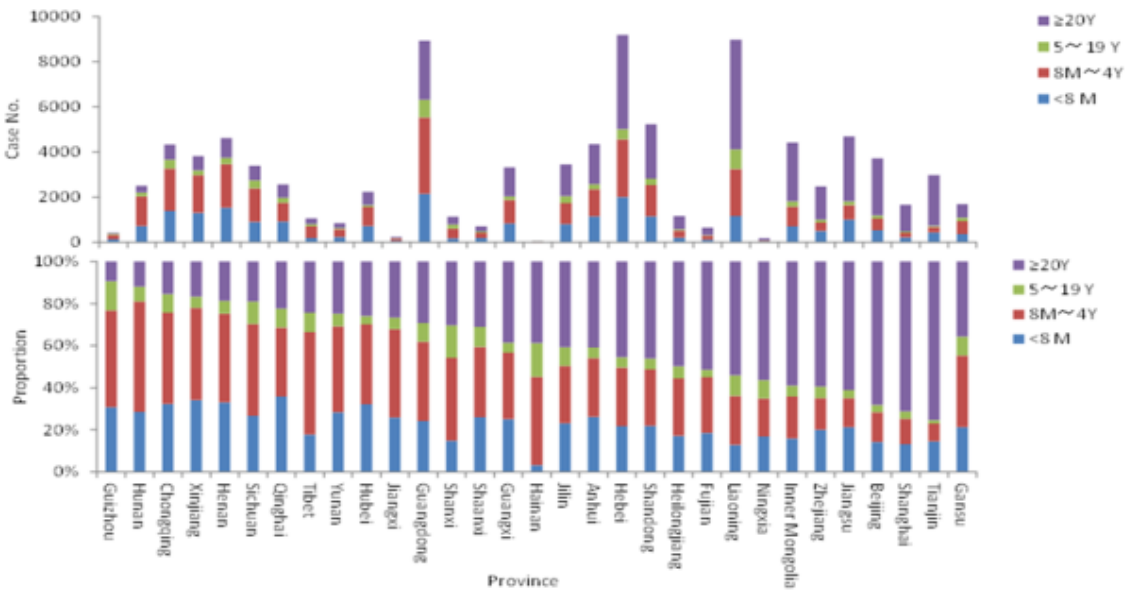
Figure 2. Number of measles cases by province from Jan-Sep 2014



Note: Cases are evenly distributed by county, 1 dot = 1 case.

Figure 3. Measles Cases Number and Proportion by Age-group, China, 2005-2014





3. Five key strategies

1) **Has the country achieved and maintained high population immunity through vaccination with 2 doses of M/MR/MMR vaccine?**

Yes, but with a caveat. This assessment is based on the administrative data method used in the Joint Reporting Form. National reported coverage is always showing high population immunity in the entire country. Coverage for MCV1 and MCV2 has been reported to be 98% or more for the last several years.

However, some smaller, local surveys that use records of individual, sampled children show lower coverage, with coverage ranges of less than 70% to 95%. Surveys of migrant children show substantially lower coverage. Studies conducted by China CDC have shown that the administratively-reported coverage overestimates true coverage based on other methods of measuring coverage.

There is concern in the program that overestimation of coverage is a significant problem. The evidence supporting this concern is that measles still circulates continuously in China despite reported very high coverage rates with 2 doses of MCV. To address this concern, the EPI division is planning for an external evaluation of coverage assessment in China in 2016. The external evaluation will make recommendations to develop a more valid coverage measurement system.

2) **Has the country develop an effective disease surveillance system supported by a WHO accredited laboratory?**

Yes. China now has a case-based, on-line-reporting measles surveillance supported by WHO accredited reference laboratories at the national and provincial levels. In 2013, an updated measles surveillance guideline was issued by China CDC to integrate the measles and rubella surveillance together.

China reports the required measles surveillance quality indicators on a monthly basis to WPRO. In 2014, China's surveillance quality indicators exceed the minimum criteria set by WPRO. The surveillance system has been able to detect several imported cases of measles against the background of indigenous measles, providing some assurance of surveillance sensitivity.

Laboratory support for viral vaccine-preventable diseases is provided by China CDC's Institute of Viral Diseases Control and Prevention. China CDC serves as a regional reference laboratory for measles, rubella, polio and Japanese encephalitis. China's 31 provincial laboratories are part of the WHO laboratory networks for polio, measles and rubella in the Western Pacific Region. China CDC's National Measles Laboratory has been a WHO regional reference laboratory since 2003, with continuous, annual recertification since then. A full range of laboratory services are provided, including serological testing, polymerase chain reaction (PCR), and genotype analysis. In 2013, real-time PCR was extended to the prefecture level.

The laboratory network for measles and rubella has four levels of service: sample collection at the country level, serological testing and real-time PCR at the prefecture level, virus isolation at the province level with some provinces able to do genotyping, and genotyping and quality control at the national level. Quality assurance is provided through systematic review of each upper level laboratory to the laboratory one level below.

Figure 4. Measles Surveillance Performance, China, 2010-2014

Category	Target	2010	2011	2012	2013	2014
Epidemiologic surveillance indicators						
National reporting of discarded measles cases	≥ 2 per 100 000	1.4	1.8	2.3	3.7	4.3
% of 2nd level admin units reporting ≥ 1/100 000 discarded measles cases	≥ 80%	29	42	59	90	90
% of suspected cases with adequate investigation	≥ 80%	87	93	98	98	98
% of suspected cases with adequate blood specimens	≥ 80%	77	90	97	97	97
Proportion of clinically confirmed measles cases	≤ 10%	30	10	3	9	8
Laboratory Indicators						
NML accredited?	Yes	Yes	Yes	Yes	Yes	Yes
% specimens with results within 7 days of collection	≥ 90%	85	94	95	97	95
% of outbreaks with specimens for virus detection	≥ 80%	40	76	36	60	78

3) Has the country been successful in conducting outbreak preparedness and response?

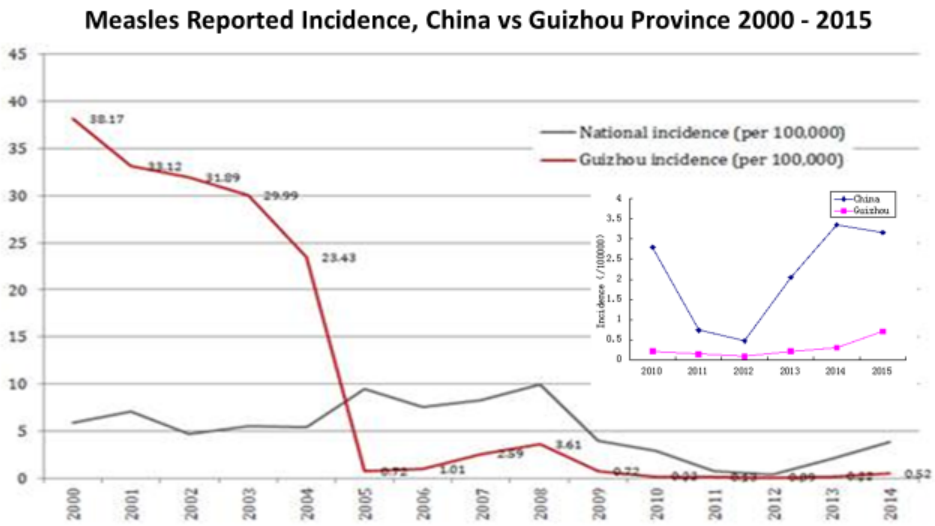
Yes. In China, an outbreak is defined as the occurrence of two or more confirmed measles cases in a village/district/school or similar unit within 10 days, or five or more confirmed measles cases in a township level unit within ten days. China CDC issued national guideline on measles outbreak response in 2013 and held a series of workshop or training course for local CDC professionals. Outbreaks are investigated more thoroughly now than prior to issuance of the guidelines, but there is a feeling among the measles epidemiologists that the outbreak response guidelines need to be updated. In 2015, China CDC began a process to update the outbreak response guidelines with a goal to issue new guidelines in 2016. The intent is to have more effective guidelines that fit better with the epidemiologic situation in China.

4) Has the country developed communication strategies to build public confidence in vaccination?

Not completely. A long-term communications strategic planning process is ongoing, but still incomplete. China CDC has developed and used surveys of parents and providers about their confidence in vaccines and immunization. The surveys were developed using focus groups of parents. In late 2013, the surveys were used to monitor parental confidence in near-real-time during a response to a set of coincidental infant deaths following hepatitis B vaccination. Thus, monitoring public confidence in vaccines is feasible in China. However, developing and implementing a comprehensive communications strategy still needs to be accomplished.

5) Has the country implemented innovative strategies or conducted operational research to access previously unreached communities with vaccination services and/or disease surveillance capability?

Yes. Innovative strategies and operations research have been used to reach previously unreached communities. A good example is the Guizhou province project to accelerate measles that was conducted between 2003 and 2009. This project made use of school vaccination record checks and other techniques to improve timeliness of measles vaccination as the organization of SIA and enhancing measles surveillance. In the same province, the implementation in 2007 of a Yellow card warning system permitted better management and funding of EPI with sustained high coverage and low incidence.



From 2012 cases count started to raise with highest incidence in children < 1 year of age and 30% of cases been between 8 and 11 months all of this in spite of having over 99% routine reported coverage with MCV1&2 for 2010-2015. Main reasons for this susceptibility are the 1) difficulties to vaccinate the "non-officially registered" 2+ and migrant children; 2) school strategy affected by vaccine availability; 3) lack of routine immunization capacity in few township and the 4) shortage of Human resources in Epi clinics.

Another example is a measles case-control study conducted by China CDC in 2013 and 2014. This study looked at risk factors for measles and found, for example, that migration and nosocomial transmission were the leading risk factors for measles.

The school vaccination entry record check program is an innovative strategy that can reach all children, since attendance at school is mandatory in China (and over 99% of children are in school). The school entry vaccination check program was made a national requirement in 2005 when the Ministry of Health and the ministry of education jointly issued a document that stated that immunization certification cards were required to be checked when children enter primary school or kindergarten. In 2010, 5 ministries, including MOH, require that the kindergarten and school entry checking needs to be strictly implemented. In 2013, the school/kindergarten entry children's 2 doses of MCV coverage were included in the basic public health service project evaluation.

A great many published articles exist describing status, challenges, and strategies for measles control and elimination.

What were the critical success factors?

Desire to have a strong routine program. The government of China wants to eliminate measles through a strong routine immunization program. The process of elimination of measles can strengthen routine immunization.

Capable program. China has an excellent immunization program that has achieved great results – for example, eliminating polio and reducing chronic hepatitis B among children by over 97%. China's immunization program has a high level of political commitment.

Measles elimination strategy. China has a sound measles elimination strategy. The epidemiology of measles in China is consistent with good to excellent implementation of this sound strategy. The timely coverage and strong routine immunization is the most prioritized strategies to achieve high population immunity against measles, and the most efficient means to implement routinely recommended vaccines.

Surveillance system. China has the largest case-based, on-line-reporting measles surveillance in the world. It has shown that the surveillance has a high quality performance in last several years. The surveillance system can find gaps in immunity, routine program weaknesses, and specific causes for failure to vaccinate – information leading to action.

Laboratory network. China's laboratory network for measles (and rubella and polio) is world-class. China has 50% of the world's measles laboratory capacity.

National serological survey. With support of the Measles & Rubella Initiative, a large (n=31,000) serosurvey for measles and rubella was conducted using residual serum from a 2014/15 hepatitis B serological survey (ages 1 to 29 years). Results will be available in the second quarter of 2016 and will provide data for program actions.

School entry record check. China's school entry check program has improved gradually and accomplished in most of the kindergarten and primary school. . It provides both an assessment of protection and an intervention to encourage vaccination. Based on data from the surveillance system in 2014, the age group distribution show that the case aged from 5-19 are only less than 5% of all confirmed measles cases.

Information systems. China has a quite well developed set of Immunization Information Systems (IIS) implemented at province level. These IIS serve as official vaccination records for clinics and have potential to be of great service for recall and reminder systems to help keep children up to date.

What were the significant barriers to achieving targets?

Demographics. China is the world's largest country and is densely populated with many very large urban areas. China has the world's largest urban migration, with an estimated 236 million individuals, primarily in families, currently migrating from rural areas to urban areas. The number and proportion of migrating women of childbearing age is increasing year by year – in 2012, 25% of childbearing-age women were migrating. Identifying and conducting outreach to migrating children is a huge challenge. High population density with high mixing of individuals leads to higher effective

measles reproductive numbers, implying that higher coverage is likely to be needed in China than in other large countries, such as the United States.

Vaccines. The program vaccines are known to be effective, but there continue to be spot shortages of MCV. One challenge to maintaining continuous supplies of MCV is the many different types of vaccines available in the EPI system – M, R, MR, MMR, and MM are all available.

Coverage assessment. Using administrative data to estimate coverage provides unrealistically high figures not consistent with current measles epidemiology or school-entry assessments. Migrant and 2+ populations and age-based recommendations of more than one dose of vaccine complicate denominator estimation. Unrealistically high estimates of coverage ultimately undermine confidence in vaccination strategies, giving false assurance that children are protected and a false sense that the program cannot improve coverage, leading to a lack of understanding about why outbreaks occur.

Parental confidence in vaccines. Parental concern about the safety of vaccination leads to missed opportunities to immunize. Providers tend to be overly cautious in the interpretation of vaccination contraindications. Well-publicized severe AEFI cases have damaged some parental confidence in vaccines and immunization. Children tend to ultimately be vaccinated, but the timeliness of vaccination can be compromised by deferred vaccination and missed opportunities.

Healthcare setting transmission. Nosocomial transmission of measles, especially for children too young to vaccinate, is an emerging challenge as China gets closer to elimination of measles.

Adult susceptibility to measles is becoming increasingly apparent, as is being seen with several adult-based outbreaks. For several years, smaller measles vaccine doses were used, with an unknown impact on long-term immunity.

School record check implementation. The school vaccination check and referral program works for all vaccines routinely recommended for preschool children. However, the implementation of the school vaccination check varies from outstanding (checking, referring, and assuring vaccination) to partially implemented (checking and referring, but not assuring vaccination). The main barrier for this program is lack of a national guideline of school vaccination check and referral program combined both of education department and health department.

Finances. Despite high political commitment, China's immunization program appears to be under-resourced relative to its responsibilities and expectations. Persistent and pervasive unmet human and financial resource needs will lead to underachievement relative to the program's potential to keep children healthy in China. In 2009, immunization was grouped together with 11 other public health services and now competes with these other services for financial support.

Conclusion and lessons learnt

What can be achieved by 2020 with current projected resources?

- Given very good political commitment, a smart and capable immunization program, and additional resources, China will be able to make good progress toward elimination of measles in the next 4 years. However, projection of future resources to the program are not yet available.

- Strengthening the school vaccination check can assure 2-dose protection of school children. However, it may be necessary to conduct a nationwide selective SIA among preschool children whose parents or the IIS cannot show documented receipt of 2 MCV doses
- It may be necessary to conduct adult vaccination campaigns in some provinces, depending on analyses of the serological survey in conjunction with measles surveillance data. These campaigns will require significant resources, but they could accelerate measles elimination.

What additional activities, strategies/tactics, and resources are needed to achieve, or maintain, the regional targets?

- Strengthening and unifying the school vaccination record check program in conjunction with the Department of Education.
- Development of more effective approaches to reach migrating and 2+ children.
- Determination of whether an adult campaign needs to be conducted (the M&RI-funded national serological survey should help with this determination).
- Development of more accurate coverage assessment (external evaluation planned for 2016).
- Evaluation of SIA and ORI effectiveness.
- Improve guidelines to reduce nosocomial transmission of measles.
- Streamline supply of measles and rubella vaccines use so that only MMR (1&2) and MR (campaigns) are used by the program.
- Update the standards of immunization practices to reduced missed opportunities to immunize.
- Complete and implement the comprehensive communication strategy for vaccines and immunization.
- Determine whether the program financing needs reform or strengthening.

Country Case Studies - Philippines

Demographics

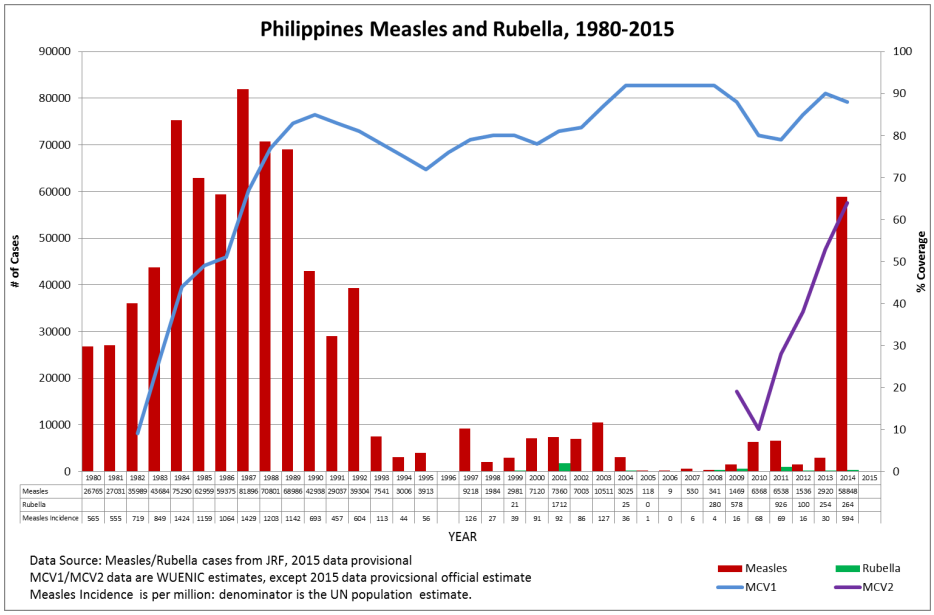
The Philippine population reached the 100-million mark on 27 July 2014, from the 98,909,981 recorded on 2 January 2014. Ranked as 12th most populous country in the world, the Philippines has 1.38% of the world's population. The Philippine Statistics Authority (PSA) sees a continuing population growth over the next 37 years. Three babies are born every minute in the country. The Commission on Population estimated that of 100 million Filipinos, youth make up 33%.

Summary of progress towards regional measles/rubella targets as of 2014

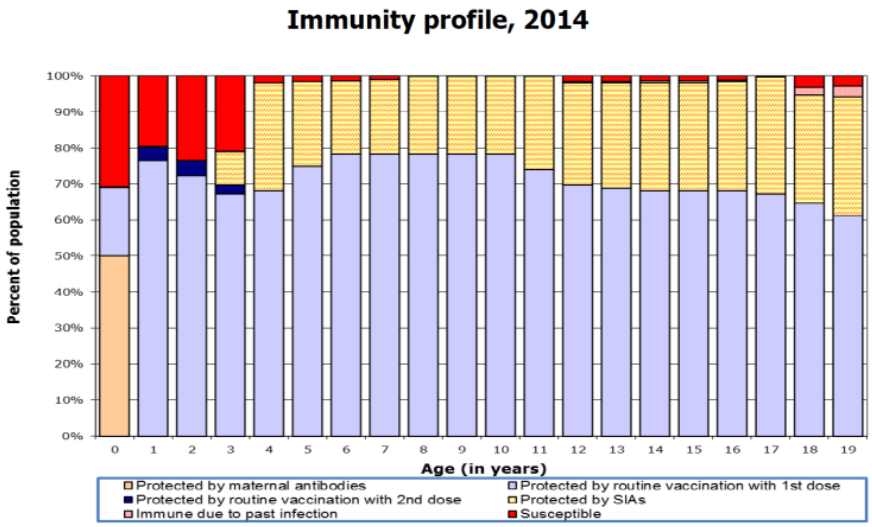
Measles vaccine was 1st introduce in 1983 and a 2nd dose in 2010 at the same time M was replaced by of MMR. Since 1998, 5 SIAs have been conducted with fluctuating coverage reaching an estimated 75 million children.

Supplementary immunization activities (SIAs)

Year	Age	Vaccine type	No. vaccinated	Coverage
1998	9m-14y	M	22 950 000	85%
2004	9m-7y	M	17 474 136	95%
2007	9m-48m	M	8 216 421	95%
2011	9m-9y	MR	15 649 907	84%
2013	<5y	M		
2014	9m-5y	MR	10 000 000 +	91%



Because of inadequate vaccine coverage through routine and SIAs a large proportion of susceptible has accumulated in children under 4 years.



Five key strategies

a. Has the country achieved and maintained high population immunity through vaccination with 2 doses of M/MR/MMR vaccine?

No, measles coverage, MCV1 and MCV2, has been consistently low in the country, 81% and 48% respectively in 2013 and 74% and 54% in 2014. The annual coverage for routine measles vaccination has never reached the target of at least 95%. An indication of this is the high transmission observed among the 9-59 months age group in 2013 and 2014. Following the SIA of MR-OPV SIA of September 2014, there was high transmission observed among older age groups; young adults were still susceptible. Confirmed post-SIA measles cases throughout the Philippines:

Region	Total Population 2010	October - December 2014 (3 months)*							
		0-8m	9m-5y	6-10y	11-15y	16-30y	31-40y	41y≤	Total
CAR	1,616,867	0	0	0	0	0	0	0	0
1	4,748,372	4	2	4	1	2	0	0	13
5	5,420,411	4	7	0	4	0	0	0	15
NCR	11,855,975	4	7	0	1	3	1	0	16
8	4,101,322	7	3	1	4	8	2	0	25
CARAGA	2,429,224	6	4	1	4	5	4	1	25
2	3,229,163	6	4	2	5	8	1	0	26
3	10,137,737	7	7	0	4	10	1	1	30
7	6,800,180	7	10	4	6	10	3	1	41
4A	12,609,803	10	15	11	9	14	4	0	63
9	3,407,353	12	19	6	2	21	11	1	72
4B	2,744,671	13	15	7	9	24	5	0	73
ARMM	3,256,140	27	58	14	9	9	3	0	120
6	7,102,438	11	20	9	19	50	15	5	129
11	4,468,563	61	33	7	14	41	12	0	168
10	4,297,323	51	38	12	32	70	39	1	243
12	4,109,571	83	73	20	28	84	30	5	323
TOTAL	92,335,113	313	315	98	151	359	131	15	1382

*Partial data received as of 20 December 2014

b. Has the country develop an effective disease surveillance system supported by a WHO accredited laboratory?

Yes. The DOH through its Epidemiology Bureau (EB) ensures that the Vaccine Preventable Disease Surveillance (VPDS) has dedicated Disease Surveillance Officers (DSO) that serve as focal points for each of the Vaccine-Preventable Diseases (VPD). The national Measles DSO religiously monitors the standard surveillance performance indicators and assists the subnational level in capacity building to ensure that the elimination goal will be attained and sustained. The DOH EB recently updated the guidelines (Administrative Order No. 2014-0003) to strengthen laboratory confirmation of suspected measles cases, particularly during outbreak situation.

In 2014, there was the development of the national measles outbreak response guidelines, which was aimed to help the local epidemiology and surveillance units to strategically collect specimens from measles suspects. In addition, the guidelines also highlighted the (1) recommended immunization and surveillance response to measles outbreaks and (2) establishment of epidemiologic-linkage among suspected measles cases without specimen or for those with specimen but the NML is unable to test.

Building on the lessons learned from the outbreak response immunization activities, the different regions and LGUs are now better prepared in dealing with surveillance and immunization response to measles outbreaks. The Administrative Order No. 2014-0003 has been circulated by the DOH EB and is now being used by the different RHOs, PHOs and CHOs in improving measles surveillance sensitivity and deciding which appropriate course of action must be taken considering their local situation.

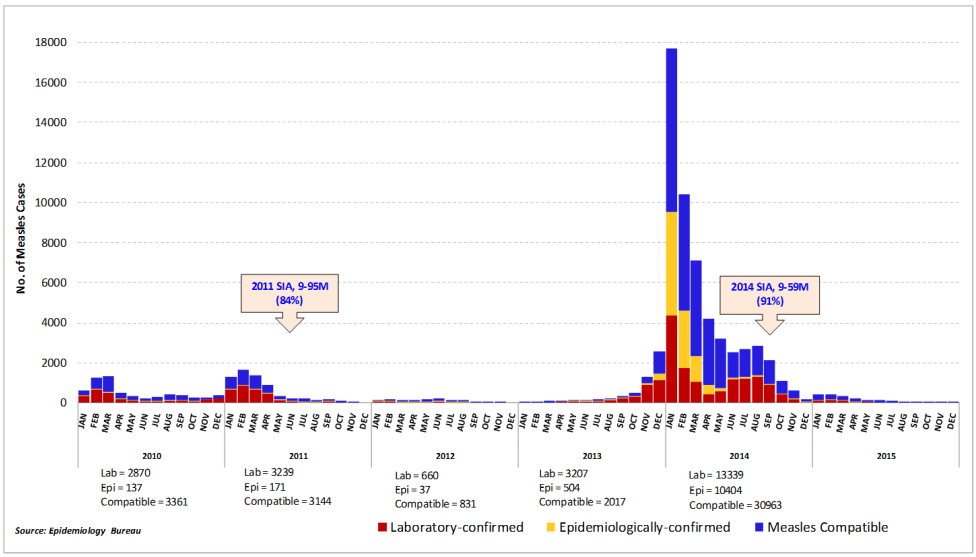
Measles surveillance has improved with the support of a fully accredited national measles laboratory. The Research Institute for Tropical Medicine (RITM) was designated as the national referral laboratory for measles and other exanthemas since 2000. It obtained the WHO recognition as the NML in 2001. The laboratory has been fully accredited by WHO as the NML in 2008. It regularly receives proficiency panel as part of External Quality Assessment and participates in the annual on-site review as part of the WHO accreditation. The NML receives financial and technical assistance from WHO Western Pacific Region (WPR) Measles and Rubella Laboratory Network. It also receives annual sub-allotments from the DOH EB to support VPDS. The measles outbreak of 2010 and 2014 revealed the inability of the current surveillance and laboratory capacity to handle massive measles outbreaks, resulting in too many cases not fully investigated and specimens submitted not fully tested.

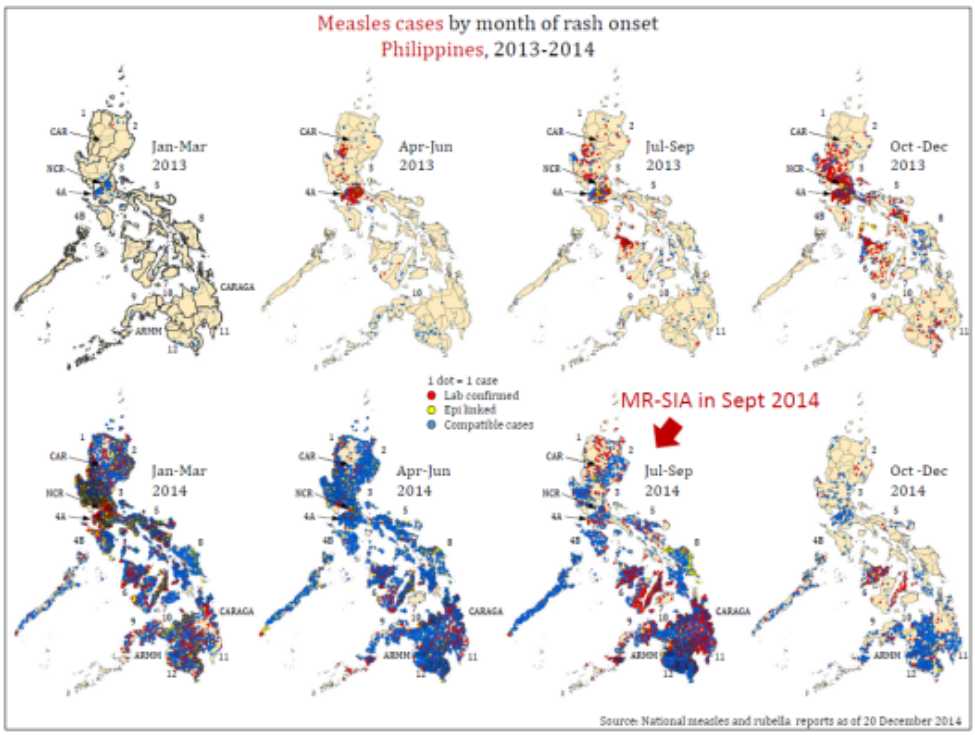
Has the country been successful in conducting outbreak preparedness and response?

Yes, the Philippines did conduct outbreak response immunizations during the measles outbreaks of 2013 and 2014. There is no data for coverage from the 2013 outbreak response. Coverage was not optimal for the Expanded Measles Catch-up Immunization of January and February 2014 which occurred in only certain regions of the Philippines:

Region	Given MV before the Expanded Catch-up	Expanded Catch-up Measles Immunization		
		Eligible Pop	No.Vaccinated	%
NCR	619,977	840,499	643,714	77
IV-A*	203,805	948,394	687,849	76
III*	167,575	395,078	364,367	92
TOTAL	991,357	2,183,971	1,695930	78

In addition, there were issues with accuracy of denominator, reporting, and coverage of migrant's populations and populations living in slums. Lastly, delayed organization of SIA in front of an outbreak limit impact of such initiative.





Has the country developed communication strategies to build public confidence in vaccination?

Yes. Renewed political and financial commitment, strong support from the DOH local and international partners, continued cooperation between the public and private health sectors, the intensified advocacy, and heightened social mobilization are needed to put the country back on track towards its goal of measles elimination.

Public's cooperation was high during the immunization activities in response to the measles outbreaks of 2013 due to the effective and intensive televised public health advertisement of the DOH. There was a high demand for measles vaccine even from families living in high-income communities that normally do not participate in national campaigns. Paediatricians from the private sectors also joined the DOH in providing access to MCV, offering immunizations to both children and adults.

Has the country implemented innovative strategies or conducted operational research to access previously unreached communities with vaccination services and/or disease surveillance capability?

Yes. The country's focus has now shifted to strengthening routine immunization to build upon the success of the September 2014 campaign and to support the local health force to eliminate the risk for measles outbreak, especially in areas identified as high risk, through immediate implementation of the Reaching Every Purok (community) Strategy.

What were the critical success factors?

Despite the challenges, the DOH remains devoted in strengthening the VPDS capabilities of the national and sub-national level. As capacity building seems to be of high essence, the national VPDS Team started the series of comprehensive VPDS trainings and advocacy meetings. The Team continues to conduct monitoring visits in priority regions, provinces, cities and municipalities and their respective DRUs. Technical support is being provided whenever necessary. Area specific recommendations aimed to improve VPDS performance were emphasized during those visits. In addition, the DOH provided support to enable its regional health offices to hire dedicated VPD surveillance officers, which will focus on surveillance for measles, AFP and NT. In a demonstration project, WHO provided 2 SSAs to serve as dedicated VPD surveillance officers at the regional offices which was effective in improving surveillance. As a result, Philippines DOH decided to scale up surveillance staff in more regional health offices. DOH initiated a budget line item so that each regional health office would have a government-funded surveillance officer.

The Philippines remains committed to the goal of measles elimination. The successful implementation of the September 2014 nationwide measles-rubella-polio mass immunization (MR-OPV MI) campaign targeting 11 million children aged 9 months to 59 months is an affirmation of the country's commitment to eliminate measles. The Philippines continues to experience economic advancement which also leads to increased investment in health systems and service delivery. Still, more needs to be invested to provide immunization coverage to the population of young adults that are susceptible to measles.

Annual budget allocation for VPDS staffing and operations, monitoring and supportive supervision in identified priority areas, strengthening advocacy to key partners and sustaining capable manpower resources at the different administrative levels.

What were the significant barriers to achieving targets?

Recurring vaccine stock outs (procurement delays, inadequate supply management…) are the most important challenge and they adversely affects routine immunization! The annual coverage for routine measles vaccination never reached the target of at least 95%. To date, the highest coverage ever attained in the county is 92% and the lowest coverage was 67% (1987 DOH EPI Report). Continuing measles transmission among adult susceptibles is a challenge.

Although DOH EPI is well-funded, the funds are all budgeted to go to procurement of vaccines; not much is devoted to operational costs which lead to a lack of resources to expand the national EPI staff.

Health service delivery was devolved to the LGUs in 1991, and for many reasons, it has not completely surmounted the fragmentation issue. Health human resource struggles with the problems of underemployment, scarcity and skewed distribution. There is a strong involvement of the private sector comprising 50% of the health system but regulatory functions of the government have yet to be fully maximized.

The country has been challenged by a series of severe natural disasters, pockets of civil unrest, and calamities; also severely affecting health workers and systems.

Conclusion and lessons learnt

What can be achieved by 2020 with current projected resources?

- Improve routine immunization without any vaccine stock-out!
- Strengthen routine immunization through the Reaching Every Purok (Community) strategy
- Strengthen vaccine and supply chain management at all administrative levels
- Increase immunization coverage for MCV2
- Improve indicators for measles surveillance
- Establish CRS surveillance system

What additional activities, strategies/tactics, and resources are needed to achieve, or maintain, the regional targets?

- Increase political will at Philippines DOH; need enough resources for routine immunization; strengthen advocacy and demand generation for routine immunization
- Need the operational strategy to fill the immunity gap of young adult population
- Prevent stock-outs through improvement of the procurement system
- Increased manpower and funding at Philippines DOH for costs other than just vaccines procurement

Criteria to verify the interruption of measles and rubella virus circulation after an outbreak

To confirm the interruption of a measles or rubella outbreak, it is necessary to comply with certain criteria that allow the International Expert Committee and PAHO/WHO to certify the end of said outbreak. **Since a single case of measles is considered an outbreak in the Region of the Americas, these criteria apply to any outbreak, regardless of whether there is a single confirmed measles case.** Of note, however, these criteria complement the routine surveillance of measles/rubella/Congenital Rubella Syndrome and are not intended as substitutes for the national indicators of the country where the outbreak has occurred.

The 10 regional criteria that must be complied to verify the interruption of an outbreak are below:

Epidemiological Criteria

1. No confirmed measles cases for 12 weeks after the rash onset of the last confirmed case, in the presence of high-quality surveillance.
2. Uniform fulfilment of the surveillance indicators in the **entire** country.
3. Complete, adequate, and timely investigation of all suspected cases, including their final classifications, reported in the last 12 weeks in those municipalities where the measles virus has circulated.
4. Monitoring up to 30 days of suspected cases and contacts identified in the last 3 weeks of the outbreak.
5. Maintain negative weekly reporting in 90% of reporting units, at the subnational level in which the outbreak was reported.
6. Active case-finding in institutions and in the community of suspected measles and/or rubella in those municipalities that have not reported the absence or presence of suspected cases in the last 12 weeks (silent municipalities or those that do not comply with the reporting rate).

Vaccination Criteria

7. Verification of measles-rubella (MR) vaccination coverage $\geq$95% determined by rapid coverage of vaccine (RCV) conducted by external evaluators, with emphasis on municipalities at the sub-national level that have reported confirmed cases and those that meet at least one of the criteria below:
    - Location in area of high tourism, or those with high migratory influx.
    - Borders with high population mobility.
    - Difficult to reach (geographically, culturally, etc.).
    - Densely populated, especially with fringe settlements.
    - Dedicated to commerce/trade (fairs, markets, etc.) or highly industrialized areas.
    - With low vaccination coverage or high-dropout rates (MMR1 vs Penta3).
    - With epidemiological silence (not reporting suspected cases).

Laboratory Criteria

8. Documentation and reporting of the viral genotype identified in the outbreak to the national and international surveillance systems.
9. In case of outbreaks of dengue, chickungunya, zika or those of other febrile rash illnesses (FRI), a percentage or reasonable quantity (according to the country's epidemiological situation) of collected specimens for the specific diagnosis of the agent must be processed for IgM measles, such that the following criteria are satisfied:
    a. Must be from areas that have reported **confirmed** measles cases.
    b. Must be specimens with negative laboratory results for the specific agent.
    c. Must be obtained from a case that presented with fever and rash.
    d. Must be obtained during the 12 weeks following the last confirmed case.

10. In silent municipalities (not reporting suspected measles cases) and with outbreaks of dengue, chickuungunya, zika or those of other febrile rash illnesses, a percentage or reasonable quantity (according to the country's epidemiological situation) of the specimens collected for the specific diagnosis of the agent must be analyzed, such that the following criteria are all satisfied:
    a. Must be specimens with negative laboratory results for the specific agent.
    b. Must be obtained from a case that presented with fever and rash.
    c. Must be obtained during the 12 weeks following the last confirmed case.

Date: October 1st, 2015

[i] Mokdad AG, Gagnier MC, Colson KE et al. (2015) Missed Opportunities for Measles, Mumps and Rubella (MMR) Immunization in Mesoamerica; Potential Impact on Coverage and Days at Risk. PLOS One 10 (10: e01396080

[ii] Ortega-Sanchez I, Vijayaraghavan M, Barskey A, Wallace G. The economic burden of sixteen measles outbreaks on United States public health departments in 2011. Vaccine 32 (2014) 1311-1317