

## GOAL 2: ACHIEVE MEASLES ELIMINATION (indicator G2.2)

### **Highlights**

The following are highlights from the **global level**.

- Worldwide measles morbidity and mortality has been reduced by >90% since the introduction of measles vaccine and four out of every five children are receiving their first dose of measles-containing vaccine (MCV1) through routine services. In addition, each year more than 100 million children receive MCV through supplementary immunization activities (SIAs).
- Because of the highly infectious nature of measles, in order to achieve elimination, the programme target for vaccination coverage is 95% or higher, with two doses of MCV delivered through routine services and/or SIAs. To prevent measles outbreaks, this high level of coverage needs to be achieved uniformly across all districts and very high levels of immunity need to be maintained across all age groups.
- In 2014, 39% and 21% of Member States reached the MCV1 and MCV2 coverage target of at least 95%. However, the global MCV1 and MCV2 coverage levels were 85% and 56%, respectively – both short of the programme targets.
- Since 2010, global measles incidence has decreased by 19% from 50 cases per million population in 2010 to 40 in 2014, which is substantially higher than the global 2015 target of fewer than five cases per million population.
- Between 2000 and 2013, estimated measles deaths decreased by 75% (from 544 200 to 145 700); however, the rate of decline has plateaued meaning that the achievement of the 95% mortality reduction target by the end of 2015 is not possible.
- Based on current trends and programme performance, the 2015 global targets for MCV1 coverage, measles incidence and measles mortality reduction will not be achieved on time.
- In decreasing order, the following six large Member States had the highest number of susceptible infants in 2014 and accounted for over two thirds of the measles mortality burden in 2013: India, Nigeria, Pakistan, Indonesia, Ethiopia, Democratic Republic of the Congo.
  - In these six Member States, routine MCV1 coverage has either shown little progress or has declined since 2010. There is a need to strengthen health systems as a whole and ensure that immunization services are included in national budgets to achieve equitable, high coverage with measles and rubella vaccines (and all other vaccines).
  - Unless the quality of immunization services (both routine and campaign delivery of measles vaccine) can be improved in these Member States, the 2015 global measles incidence and mortality reduction targets will not be met.
  - A strategic cross-cutting approach by all immunization stakeholders is needed in these countries to address the combined challenges of lack of health infrastructure and human resources as well as civil conflict in some areas.

The following are highlights from the **regional level**.

- All six WHO regions have established measles elimination goals with target dates in or before 2020.
- Measles incidence has decreased in three of the six WHO regions in the past 12 months (the African, Eastern Mediterranean and European regions) whereas in the other three regions there has been an increase in incidence in the past year (Region of the Americas,

South-East Asia Region and Western Pacific Region).

- In the **African Region**, many countries continued to experience measles outbreaks. Large outbreaks occurred in 2014 in Angola, Democratic Republic of the Congo, Ethiopia, 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, where a wider age range is indicated, and delaying introduction of MCV2 and rubella-containing vaccine (RCV) because of uncertainty about future financial commitments.
- The **Region of the Americas** achieved measles elimination in 2002 and sustained the elimination for more than 10 years. The reestablishment of endemic measles transmission in Brazil in 2014 highlights the constant risk of spread from importations, especially in communities with low vaccination coverage. Experience in the Americas indicates that maintaining elimination may be more challenging than achieving it because of the problems of complacency, declining routine coverage, decreasing quality of surveillance and competing public health priorities.
- Despite the progress in the **Eastern Mediterranean Region** where fewer cases were reported in 2014 than in 2013, some countries including Afghanistan, Pakistan, Somalia, Sudan, Syria and Yemen experienced several measles outbreaks from late 2010 to 2014. Egypt and Iraq also had outbreaks in 2014 with significant increases in reported numbers of cases compared to 2013. These outbreaks occurred as a result of delay in implementation of the follow-up SIAs, a deteriorating security situation, and/or inadequate funds.
- The **European Region** continued to experience outbreaks in 2014 in Bosnia and Herzegovina, Georgia, Italy, Russian Federation and Ukraine. However, with about 50% fewer measles cases reported in 2014 (n = 14 020) than in 2013 (n = 26 385), the number of cases in the Region appears to have dropped to the lowest level since 2010 (n = 30 625).
- The **Western Pacific Region** is being challenged by measles outbreaks, with most of the cases occurring in China, Papua New Guinea, the Philippines and Viet Nam. Overall, less than 20% of Member States in this region have interrupted measles transmission.
- Following the establishment of a measles elimination target of 2020 in the **South-East Asia Region** in 2013, all countries drafted, and some adopted, national plans of action to achieve these goals. By the end of 2014, regional coverage with MCV1 had increased to 84% and with MCV2 to 59%.

#### General highlights

- Much stronger country ownership and political commitment to measles elimination goals will be needed to get back on track towards elimination in the regions.

For Member States with routine measles coverage <90% nationally (72 Member States in 2014), reaching and sustaining ≥95% coverage will require substantial additional investments over a sustained period.

<b>DEFINITION OF INDICATOR</b>	<p>Framework for verification of measles elimination (1) lists the following.</p> <ul style="list-style-type: none"> <li>• Measles eradication: worldwide interruption of measles virus transmission in the presence of a surveillance system that meets specified performance indicators</li> <li>• Measles elimination: the absence of endemic measles transmission in a defined geographical area (e.g. region or country) for ≥12 months in the presence of a well-performing surveillance system</li> </ul> <p><i>Note:</i> Verification of measles elimination takes place after 36 months of interrupted endemic measles virus transmission</p>
<b>DATA SOURCES</b>	<ul style="list-style-type: none"> <li>• Joint Reporting Forms (JRFs) for disease incidence and WHO-UNICEF estimates of national immunization coverage (WUENIC) data for coverage rates</li> <li>• Progress reports of the regional verification commissions: from the Regions of the Americas, Europe and the Western Pacific for outbreak data and status of countries with regard to elimination as of 31 December 2014</li> </ul>
<b>COMMENTS ON DATA QUALITY</b>	<ul style="list-style-type: none"> <li>• JRFs and WUENIC data are subject to the same limitations as all other data submitted via the JRFs, as described in the 2014 GVAP Secretariat report (2)</li> <li>• Regional verification commission reports are only available from three regions: European Region, Region of the Americas and the Western Pacific Region (note that commissions will only verify elimination if data quality standards are met)</li> </ul>
<b>MILESTONES</b>	<ul style="list-style-type: none"> <li>• Measles elimination goals by WHO region (3) <ul style="list-style-type: none"> <li>○ Americas: eliminated in 2002 (2 years after the 2000 goal)<sup>1</sup></li> <li>○ Western Pacific Region: elimination by 2012</li> <li>○ European Region: elimination by 2015</li> <li>○ Eastern Mediterranean Region: elimination by 2015</li> <li>○ African Region: elimination by 2020</li> <li>○ South-East Asia Region: elimination by 2020</li> </ul> </li> </ul>

### ***Background and progress***

The impact of the measles vaccine on global public health has been tremendous. Before 1963, most of the world's population had been infected with measles virus by their 15th birthday, resulting in an estimated 100 million cases and more than 2 million deaths annually (4). By 2000, four decades of steadily increasing use of the vaccine had led to a dramatic reduction in the number of cases to just over

<sup>1</sup> Brazil is facing re-established measles transmission owing to an uninterrupted outbreak in two states, which started in 2013. Brazil is taking aggressive measures to interrupt measles transmission.

half a million annually. In 2002, the Region of the Americas stopped endemic transmission of measles (i.e. measles was eliminated from the region) and sustained the elimination for more than a decade.<sup>1</sup>

Since the sixty-third World Health Assembly in 2010 endorsed three global measles targets for 2015 as milestones towards global eradication of measles,<sup>2</sup> however, progress has been slow.

Between 2010 and 2014, **global routine measles vaccine coverage** stagnated at 85% – well below the 2015 target of ≥90% **Table 3**). By region, three of the six WHO regions have sustained MCV1 coverage above 90% (Region of the Americas, European Region and Western Pacific Region), one region achieved coverage between 80 and 90% (South-East Asia Region) and two regions achieved coverage below 80% (African Region and Eastern Mediterranean Region). The number of Member States achieving the global MCV1 coverage target at the national level remained the same in 2014 as in 2010; 122 Member States achieved the ≥90% MCV1 national coverage target<sup>3</sup> (**Table 3, Figure 7**).

Since 2010, global **reported measles incidence** has decreased by 19% from 50 cases per million population in 2010 to 40 in 2014 with only one region (Region of the Americas) meeting the global 2015 target of fewer than five cases per million population (**Table 3 and Figure 8**). During the same period, there was a decrease in the number of Member States (95 Member States in 2014 compared to 114 Member States in 2010) meeting the global 2015 incidence target.

Between 2000 and 2013, **estimated measles deaths** decreased by 75% (from 544 200 to 145 700) and all regions reported substantial reductions in estimated measles mortality. However, the progress since 2010 has been too slow (from 69% mortality reduction in 2010 to 75% in 2013) making it highly unlikely that the target of 95% mortality reduction can be achieved by the end of 2015.

In 2014, 154 (79%) Member States had introduced a second dose of MCV (compared to 136 (70%) in 2010) and **MCV2 global coverage** was 56% (compared to 40% in 2010) (Figure 9).

Among those 154 countries, 53 provide MCV2 to infants less than 2 years of age *and* have reported coverage both for MCV1 and MCV2. In these 53 countries,<sup>4</sup> the difference between MCV1 and MCV2 reached 16% in 2014 (87% MCV1 compared to 71% MCV2). This highlights the missed opportunities and routine system weaknesses that contribute to suboptimal population immunity and the inability to interrupt measles virus transmission.

Many countries regularly supplement routine efforts through the use of SIAs. SIAs vaccinated approximately 197 million children in 33 Member States in 2013 and an additional 215 million children in 28 Member States in 2014. Among 34 countries that conducted SIAs between 2012 and 2014 and that

---

<sup>2</sup> The global milestones endorsed are to: 1) exceed 90% coverage with the first dose of MCV nationally and exceed 80% vaccination coverage in every district or equivalent administrative unit; 2) reduce annual measles incidence to fewer than five cases per million and maintain that level; 3) reduce measles mortality by 95% or more in comparison with 2000 estimates.

<sup>3</sup> It should be noted that the 90% MCV1 coverage target for 2015 is a milestone towards elimination. In order to achieve the regional elimination targets, vaccination coverage needs to be >95% for two doses of MCV administered through routine immunization or routine immunization and SIAs. To prevent measles outbreaks, this high level of coverage needs to be achieved uniformly across all districts and across people in all age groups born since the introduction of measles vaccine.

<sup>4</sup> Countries that had introduced MCV2 in 2014 were excluded from this comparison,

conducted a coverage evaluation survey of the SIA, less than half (16 Member States) were able to reach the target of 95% national coverage.

Given these gaps in coverage and population immunity, it is not surprising that outbreaks continue to threaten elimination goals in all six WHO regions.

Many countries in the **African Region** continued to experience outbreaks, with large outbreaks in 2014 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, where a wider age range is indicated, and delaying MCV2 and RCV introduction owing to uncertainty about future financial commitments.

In the **Region of the Americas**, 1152 cases were reported in 2014, mostly related to two outbreaks in Brazil and in Canada. It is noteworthy that the United States reported no measles cases through JRF in 2014; however 667 cases were reported and published.<sup>5</sup> More than 80% of reported cases in Brazil, Canada and the United States were not vaccinated and, as a whole, the region has witnessed a decline in routine MCV1 coverage since 2012 with heterogeneous coverage at the subnational level where many municipalities have less than 80% coverage.

The **Eastern Mediterranean Region** has seen a decline in reported measles cases since 2012, with total numbers of confirmed cases in 2012, 2013 and 2014 of 34 504, 20 884 and 19 099, respectively. However, continued measles outbreaks occurred in Afghanistan, Pakistan, Somalia, Sudan and Yemen, despite implementation of several follow-up SIAs since 2010 with reported high coverage. The disruption of health services in the Syrian Arab Republic owing to ongoing conflict led to an increase in reported measles cases from 13 in 2012 to 740 in 2013, and 594 in 2014 with disruptive consequences for neighbouring countries hosting Syrian refugees. Since 2013, Iraq has been experiencing a measles outbreak which continues to spread countrywide in 2015. The majority of the reported outbreaks in the Eastern Mediterranean Region affect children under 10 years of age, indicating poor implementation of routine vaccination and poor quality of SIAs.

In the **European Region**, measles outbreaks affected primarily Bosnia and Herzegovina and Georgia as well as Italy, the Russian Federation and Ukraine in 2014. The majority of the reported cases in 2014 (78%) were either unvaccinated or had unknown vaccination status and more than half of those affected were 15 years of age or older.

In 2014, measles continued to circulate widely in most countries of the **South-East Asia Region** (except Bhutan, Democratic People's Republic of Korea and Maldives). While the completeness and quality of investigations of suspect cases varied among countries, it is clear that the main cause of continued measles cases was underutilization of measles vaccine. Of the 40 625 cases reported in the region, India continued to report the most confirmed and linked cases (24 977), followed by Indonesia (12 222), Sri Lanka (1686) and Nepal (1279) (Figure 8).

Measles incidence (per 1 million population) in the **Western Pacific Region** increased from 5.9 in 2012 to 17.2 in 2013 and 70.6 in 2014. This is largely the result of a resurgence of endemic transmission in

---

<sup>5</sup> <http://www.cdc.gov/mmwr/pdf/wk/mm6428md.pdf>

endemic countries (China and the Philippines) and outbreaks following importation in countries with low or no documented transmission for a certain period (e.g. Papua New Guinea and Viet Nam). The region is witnessing increased infection and transmission of measles virus among people outside the target group of current immunization strategies for measles elimination (i.e. infants aged <8 months, adolescents and adults).

These events illustrate the need for sustained efforts to raise and maintain high levels of immunization coverage even in areas where elimination-level control has previously been attained. Every opportunity to address system bottlenecks and to increase routine immunization coverage should be seized. The introduction of a routine second dose of MCV and SIAs provide such opportunities. For example, SIAs have been shown to contribute to strengthening the routine immunization programme through improving several aspects including health-worker skills and knowledge, social mobilization, cold chain and logistics, and integration of other public health interventions (5, 6).

The establishment of Regional Verification Commissions (RVCs) for measles elimination and their corresponding National Verification Committees (NVCs) has helped to refine the understanding of the barriers to elimination and build stronger national commitment to achieving elimination goals (Table 4).

The **Region of the Americas** has the longest standing RVC. As of December 2014, 98% of its Member States were verified as having achieved measles elimination (Table 5). The International Expert Committee (IEC) for Measles and Rubella Elimination in the Americas awaits the control of the measles outbreak in Brazil and fulfilment of verification criteria by an external team, to declare the elimination of measles in the Americas.

At the **Western Pacific Region** RVC meeting in 2014 (Table 6), Australia, Macao (China), Mongolia and Republic of Korea were verified as having achieved measles elimination based on a verification-standard epidemiological surveillance system supported by accredited laboratories. Three additional countries were included in 2015: Brunei Darussalam, Cambodia and Japan.

In the **European Region** (Table 7), 50 of 53 Member States have established NVCs and at the RVC meeting in November 2014, 22 (41%) of the Member States were documented to have interrupted endemic measles transmission.

In the **Eastern Mediterranean Region**, a regional verification guide was drafted but no RVC has yet been established. However, NVCs were established in 9 of 21 Member States. Three countries in the region (Bahrain, Oman and Palestine) are ready for verification, as they have reported zero cases for the past three years in the presence of a nationwide measles case-based surveillance and high coverage for both MCV1 and MCV2.

There is no measles RVC in the African or South-East Asian regions yet; however, the South-East Asian Region is likely to establish the RVC in 2015. Compared to 2013, there has been no progress in terms of the number of regions with RVCs or the number of Member States that have established NVCs.

In decreasing order, the following six large Member States had the highest number of susceptible infants in 2014 and accounted for more than two-thirds of the measles mortality burden in 2013: India, Nigeria, Pakistan, Indonesia, Ethiopia and Democratic Republic of the Congo (Figure).

For these countries, one could highlight the importance of strengthening health systems to achieve higher immunization coverage. Routine MCV1 coverage in these countries has either shown little

progress or has declined since 2010, and the reported measles incidence remains high. All six countries had low density of nursing and midwifery personnel per 10 000 population, well below the global average (Table 8). Such a shortage of health-care workers is a contributor to missed opportunities for immunization and the inability to reach global targets. In addition, discrepancies between administrative data on immunization coverage and survey data, particularly for SIAs, remains an issue. Immunization coverage reported from administrative sources is often much higher than the coverage reported from surveys( e.g. in 2013, Nigeria reported 94% coverage rate for SIA in the administrative data, whereas 75% coverage was reported through the SIA coverage evaluation survey).

### ***Conclusion***

Although in 2014 some improvement was seen in MCV2 immunization coverage and a small reduction was reported in measles incidence (compared to 2010), based on current trends and programme performance, the 2015 global targets as well as regional elimination targets, in the five WHO regions where measles is still endemic, will not be achieved.

Measles is a highly infectious disease, and its elimination requires very high and homogeneous population immunity and a high-quality surveillance system. Without a robust routine programme, elimination is very difficult to achieve and cannot be sustained. For Member States that are now at <90% coverage nationally, reaching ≥95% coverage will require substantial additional investments over a sustained period. The gap between MCV1 and MCV2 coverage highlights the missed opportunities and routine system weaknesses that contribute to suboptimal population immunity and the inability to interrupt measles virus transmission. In 2013, the Strategic Advisory Group of Experts (SAGE) on Immunization urged Member States and partners to raise the visibility of measles and rubella elimination activities and make the necessary investments of financial and human resources required to strengthen health systems and achieve more equitable access to immunization services. SAGE stressed the importance of building on the work with the polio programme to integrate measles and rubella and other critical services in a way that helps to strengthen the health system and achieve universal health care.

BACKGROUND DATA

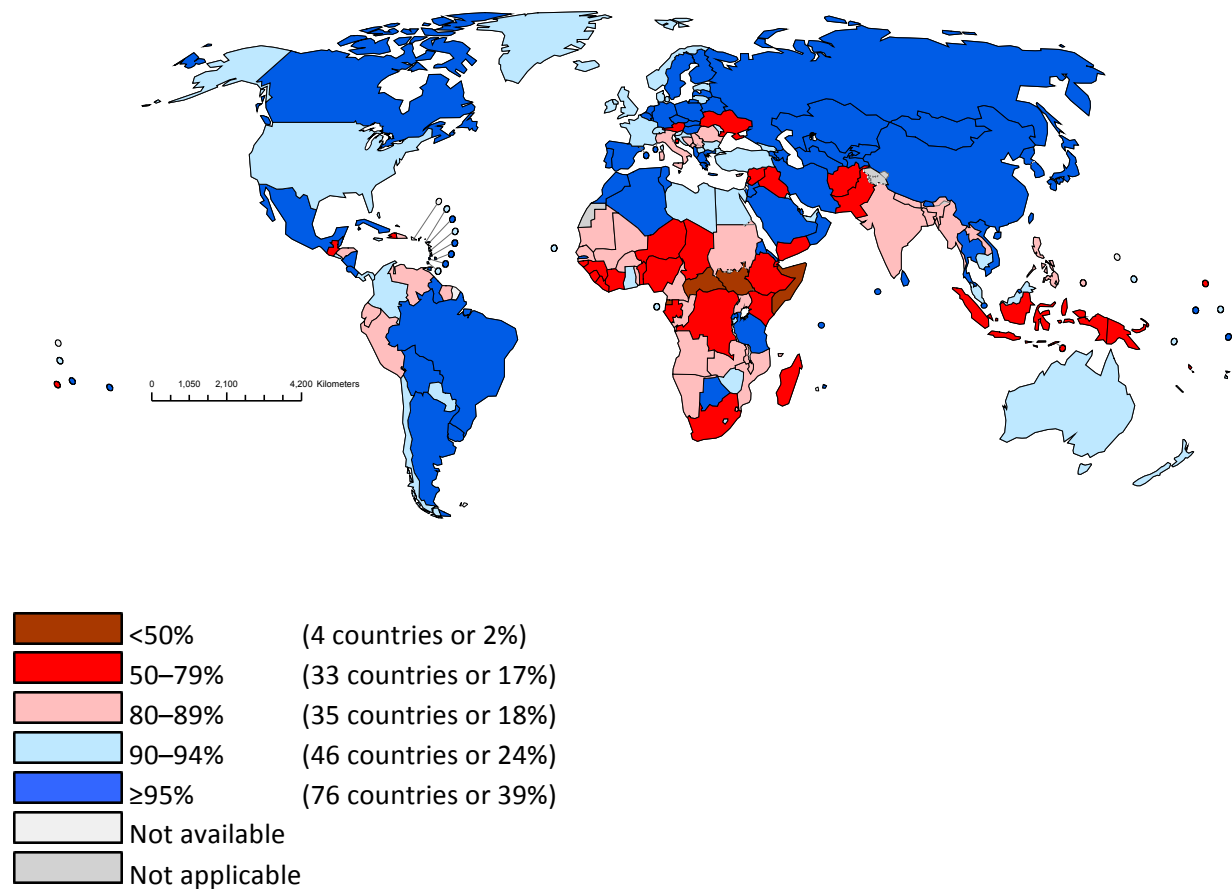
Table 3: Number of measles cases and incidence by WHO region, 2010–2014

WHO region	MCV1 national coverage					% of Member States reporting measles in their JRF <sup>a</sup>				Measles incidence per million population					Number of countries with incidence less than 5 per million population				
	2014	2013	2012	2010	% change 2010–2014	2014	2013	2012	2010	2014	2013	2012	2010	% change 2010–2014	2014	2013	2012	2010	% change 2010–2014
<b>African Region</b>	73	73	73	74	–1.4	100	100	98	100	77.7	184.6	125.6	235.1	–67	24	25	18	14	68
<b>Region of the Americas</b>	92	91	94	93	–1.1	94	97	100	100	1.2	0.5	0.1	0.3	358	32	34	35	35	–3
<b>Eastern Mediterranean Region</b>	77	78	77	81	–4.9	90	86	100	95	30.9	35.1	57.4	17.6	76	4	5	9	8	–47
<b>European Region</b>	94	95	95	93	1.1	74	85	92	98	19.2	33.7	34.0	34.1	–44	24	31	35	36	–11
<b>South–East Asia Region</b>	84	84	84	83	1.2	91	100	100	100	22.5	16.2	25.6	30.3	–26	5	5	4	4	38
<b>Western Pacific Region</b>	97	97	97	96	1.0	63	70	100	93	70.6	17.2	5.9	27.3	159	6	13	19	17	–48
<b>Total</b>	<b>85</b>	<b>85</b>	<b>85</b>	<b>85</b>	<b>0</b>	<b>85</b>	<b>90</b>	<b>97</b>	<b>98</b>	<b>40.5</b>	<b>40.3</b>	<b>33.0</b>	<b>50.1</b>	<b>–19</b>	<b>95</b>	<b>113</b>	<b>120</b>	<b>114</b>	<b>–5</b>

<sup>a</sup> List of Member States not reporting JRF measles data: Albania, Andorra, Austria, Chile, Cook Islands, Costa Rica, Croatia, Djibouti, Fiji, Finland, Ireland, Israel, Italy, Luxembourg, Marshall Islands, Monaco, Montenegro, Nauru, Niue, Oman, Poland, Samoa, San Marino, Singapore, Solomon Islands, Thailand, Tonga, Tuvalu, Ukraine.  
Source: JRF (as of 26 June 2015) and WHO-UNICEF estimates, 1980–2014, revision July 2015.



**Figure 7: Immunization coverage (%) with first dose of measles-containing vaccines (MCV1) in infants per country, 2014**



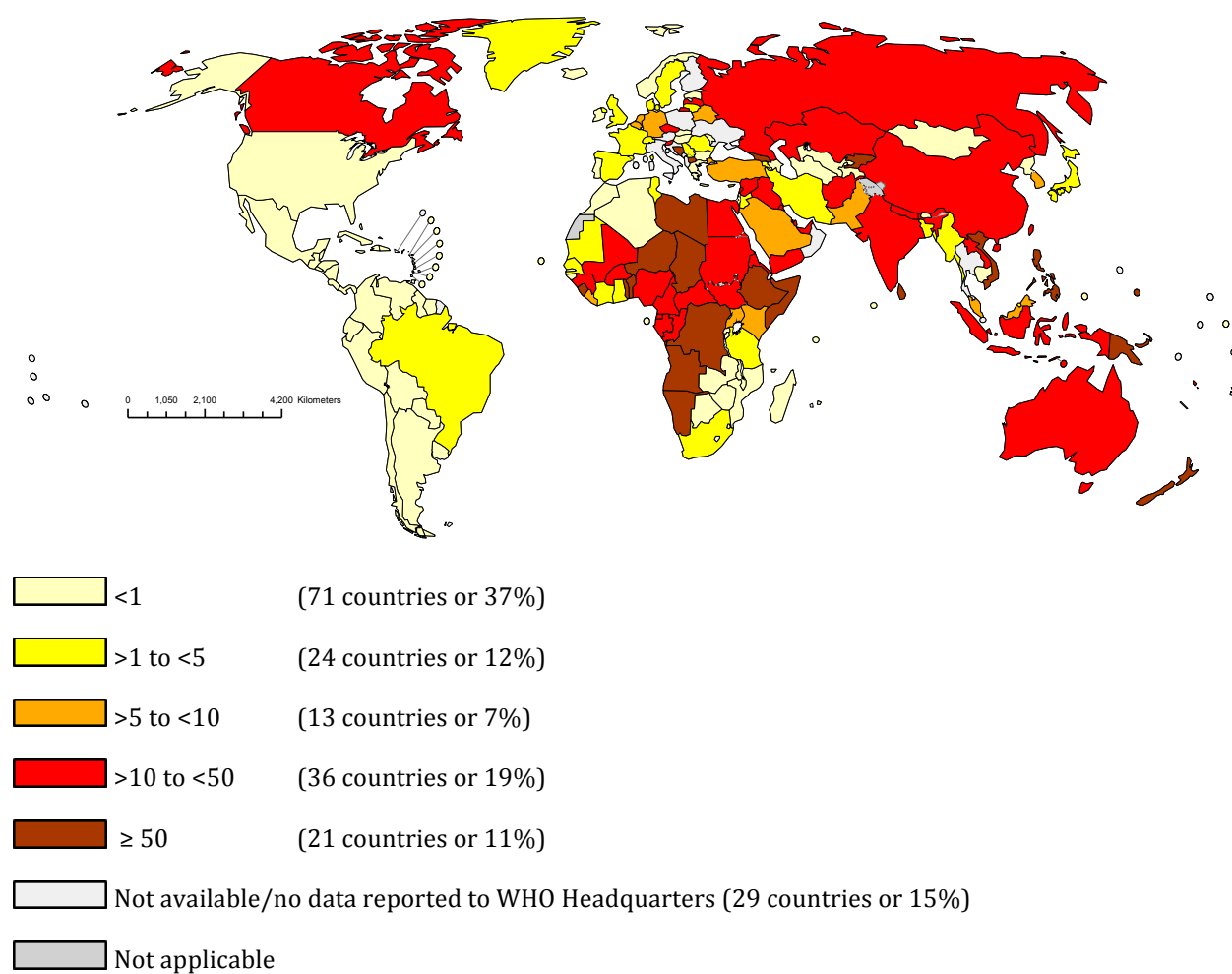
Map production: Immunization Vaccines and Biologicals (IVB). WHO

Date of slide: 16 July 2015

Source: WHO–UNICEF coverage estimates, 2015 revision.

© WHO 2015. All rights reserved

**Figure 8: Reported measles incidence rate<sup>a</sup> per country, 2014**



<sup>a</sup>Per million population

Source: Joint Reporting Form as at 26 June 2015: 194 WHO Member States.

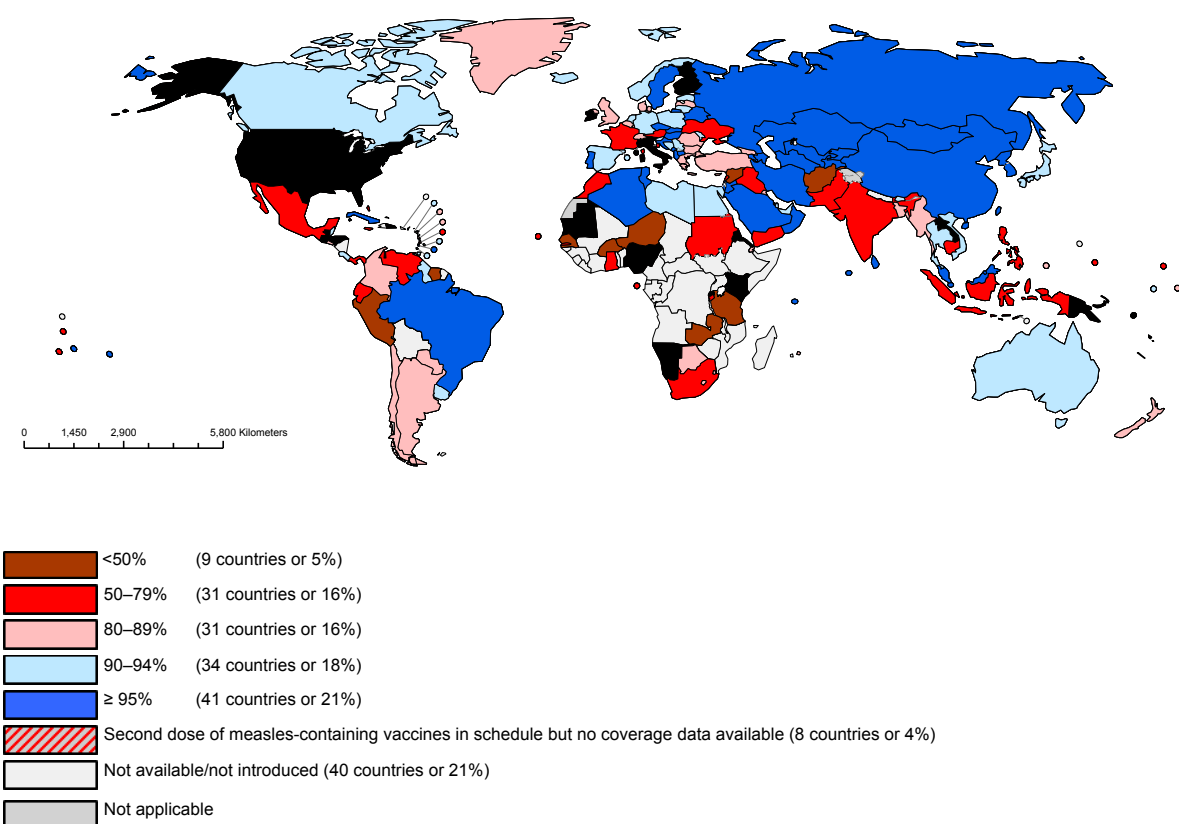
Map production: Immunization Vaccines and Biologicals (IVB), WHO.

Date of slide: 16 July 2015.

Source: Joint Reporting Form as at 26 June 2015: 194 WHO Member States.

© WHO 2015. All rights reserved.

**Figure 9: Immunization coverage with routine MCV2 by national schedule for infants, 2014**



Map production: Immunization Vaccines and Biologicals (IVB), WHO

Date of slide: 16 July 2015

Source: WHO-UNICEF coverage estimates, 2015 revision.

© WHO 2015. All rights reserved.

**Table 4: Progress towards measles elimination, by WHO region (as of 31 December 2014)**

<b>WHO region</b>	<b>Target year for measles/rubella elimination in region</b>	<b>RVC established</b>	<b>Regional measles elimination verification report provided in 2015 by RVC for 2013/2014 data</b>	<b>Member States that have established an NVC n (% of total)</b>	<b>Established NVCs that submitted annual status reports<sup>a</sup> n (% of total)</b>	<b>Member States that were verified free of endemic measles based on 2013 reporting n (% of total)<sup>b</sup></b>
<b>African Region</b>	2020	No	No	Unknown	Not applicable	Not applicable
<b>Region of the Americas</b>	2000	Yes	Verification reports sent in 2013. No need to send updates in 2014	24 (100)	Reports not submitted on annual basis	43/44 (98)
<b>Eastern Mediterranean Region</b>	2015	Yes	No	9	Not applicable	Not applicable
<b>European Region</b>	2015	Yes	Yes (for 2013)	50 (94)	46 (87%)	22 (41) <sup>c</sup>
<b>South-East Asia Region</b>	2020	No	No	Unknown	Not applicable	Not applicable
<b>Western Pacific Region</b>	2012	Yes	Yes (for 2014)	17 <sup>d</sup> (100)	17 (100) <sup>d</sup>	3 (11%)

<sup>a</sup>Percentage is out of the total number of established NVCs, not the total number of Member States. Note that a total of 46 reports were submitted to the European RVC review in October 2013. Percentage is based on Member States submitting reports in time for RVC

<sup>b</sup> Percentage is out of the total number of Member States, and not the total number of established NVCs

<sup>c</sup> These 22 countries were not verified as having been free of endemic measles for 36 months or longer, but were documented to have interrupted endemic measles transmission in 2013 (see Table 5).

<sup>d</sup> 13 Pacific island countries formed one Joint Subregional Verification Committee (they are: Cook Islands, Fiji, Kiribati, Marshall Islands, Micronesia (Federated States of), Nauru, Niue, Palau, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu). Hong Kong SAR and China, Macao SAR established their own Committees in addition to the Chinese NVC. So there are a total of 17 NVCs for 27 Member States in the Western Pacific Region.

**Table 5: Progress towards measles elimination in the Region of the Americas (as of 31 December 2014)**

Status according to Pan American Health Organization (PAHO) Region definitions	Number of countries n (% of total)	Countries
<b>Measles elimination verified<sup>a</sup></b>	43 (98)	34 countries + 6 UKOTS + 3 Dutch autonomous
<b>Re-establishment of endemic measles transmission<sup>b</sup></b>	1 (2)	Brazil

UKOTS, United Kingdom's own Overseas Territories.

<sup>a</sup>Verify interruption of endemic measles, rubella and congenital rubella syndrome cases in all countries of the Americas for a period of at least 3 years from the last known endemic case, in the presence of high-quality surveillance.

<sup>b</sup>Occurs when epidemiological and laboratory evidence indicates the presence of a chain of transmission of a virus strain that continues uninterrupted for >12 months in a defined geographical area.

**Table 6: Progress towards measles elimination in the Western Pacific Region (as of 31 December 2014)**

Status according to Western Pacific Region definitions <sup>a</sup>	Number of countries n (% of total)	Countries
<b>Elimination verified</b>	3 (11)	Australia, Mongolia, Republic of Korea
<b>Possibly ready for verification, but additional data required</b>	3 (11)	Brunei Darussalam, Japan, Singapore
<b>Interrupted transmission, &lt;36 months</b>	2 (7)	Cambodia, New Zealand
<b>Period of no or very low transmission followed by outbreak</b>	16 (59)	Cook Islands, Fiji, Kiribati, Lao People's Democratic Republic, Marshall Islands, Micronesia (Federated States of), Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu, Viet Nam
<b>Endemic transmission</b>	3 (11)	China, <sup>b</sup> Malaysia, the Philippines

<sup>a</sup>Western Pacific Region definitions:

- Elimination verified: The interruption of endemic measles virus transmission for  $\geq 36$  months in the presence of verification-standard surveillance and genotyping evidence that supports the interruption of endemic measles virus transmission.
- Possibly ready for verification, additional data required: After reviewing the first reports prepared by the NVCs, the RVC determined that interruption may have been achieved, but more detailed epidemiological data were needed to verify measles elimination.
- Interrupted transmission, <36 months: Measles transmission has been interrupted for less than 36 months. There is no endemic transmission, but verification must occur after 36 months. Cambodia reached 36 months in 2014; New Zealand in 2015.
- Period of no or very low transmission followed by outbreak: After periods of no or very low transmission in the country, there are outbreaks that are currently being monitored. An outbreak is defined as a single laboratory-confirmed measles case, whether endemic or imported.
- Endemic transmission: The existence of continuous transmission of indigenous or imported measles virus that persists for  $\geq 12$  months in the nation.

<sup>b</sup>Data apply to all parts of China excluding China, Hong Kong SAR and China, Macao SAR. Elimination has been verified for China, Macao SAR. China, Hong Kong SAR may be ready for verification of elimination, but additional data are needed.

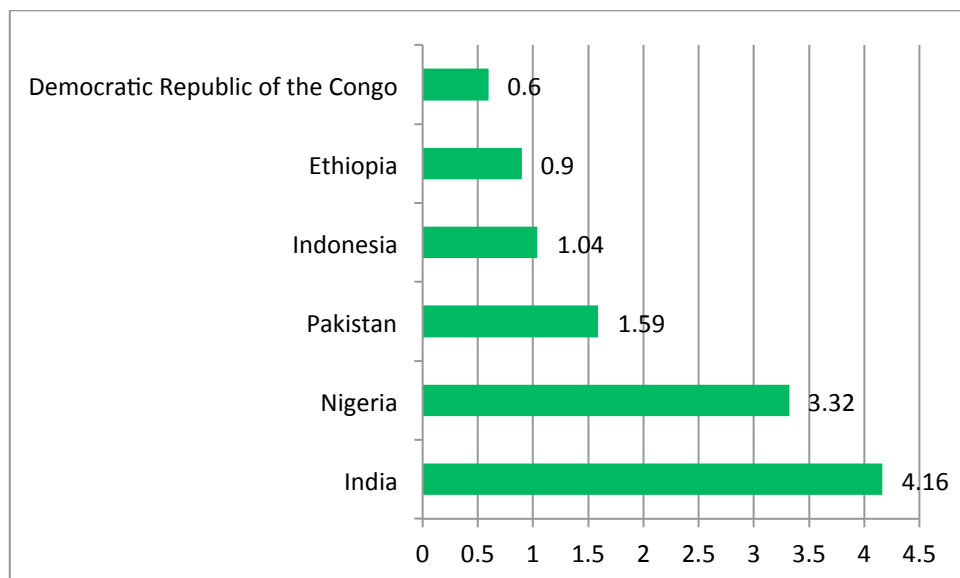
**Table 7: Progress towards measles elimination in the European Region (as of 31 December 2014)**

Status using European Region definitions <sup>a</sup>	Number and percentage of Member States n (% of total)	Member States	
<b>Interrupted transmission</b>	22 (41)		Andorra, Armenia, Belarus, Czech Republic, Estonia, Finland, Hungary, Israel, Malta, Portugal, Slovakia, Slovenia, Sweden, Tajikistan, Turkmenistan
		At risk of re-establishment	Azerbaijan, Bulgaria, Cyprus, Latvia, Luxembourg, Norway, Republic of Moldova
<b>Inconclusive (incomplete data)</b>	9 (17)	Austria, Croatia, Denmark, Greece, Iceland, Montenegro, Netherlands, Spain, Uzbekistan	
<b>Endemic transmission</b>	13 (24)	Belgium, France, Georgia, Germany, Ireland, Kazakhstan, Lithuania, Poland, Romania, Russian Federation, Switzerland, Turkey, United Kingdom of Great Britain and Northern Ireland	
<b>Not reviewed</b>	9 (17)	Late submission	Bosnia and Herzegovina, Italy, Ukraine
		To resubmit report	Kyrgyzstan, Serbia, the former Yugoslav Republic of Macedonia
		No report submitted	Albania, Monaco, San Marino

<sup>a</sup> European Region definitions:

- Interrupted transmission: Absence of endemic measles transmission in 2013 in the presence of a well-performing surveillance system. (Note: This definition differs from that stated in the WHO Weekly Epidemiological Record, which requires absence of transmission for 36 months or longer.)
- Interrupted transmission, but at risk of re-establishment: Member States that have “interrupted transmission” for 2013 (as defined above), but have  $\leq 95\%$  vaccination coverage among infants and young children. (Note: this definition differs from that stated in the WHO Weekly Epidemiological Record (7)).
- Inconclusive (incomplete data): Data provided by the NVC for 2013 are not comprehensive enough to determine the status of measles elimination in the country.
- Endemic transmission: Continuous transmission of indigenous or imported measles virus that has persisted for a period of 12 months or more in the Member State. (Note: this definition differs from that stated in the WHO Weekly Epidemiological Record.)
- Not reviewed: The Annual status report for 2013 was not reviewed because it was not submitted, submitted late or because the RVC requested that it is revised and resubmitted.
- Endemic transmission (no NVC report): The existence of continuous transmission of indigenous or imported measles virus that has persisted in 2013 according to a national public health institution that is not an NVC (different from WHO Weekly Epidemiological Record definition).
- Inconclusive (incomplete data) (NVC report): Data provided by the NVC are not comprehensive enough to classify the country’s status on measles elimination conclusively.
- No data (no NVC report): Not available because the country failed to submit the Annual status report.

**Figure10: Countries with the largest numbers of infants unvaccinated with MCV1, in millions, 2014**



Immunization Vaccines and Biologicals (IVB), WHO.

194 WHO Member States.

Source: WHO-UNICEF coverage estimates 2014, revision. July 2015.

**Table 8: Measles incidence, national MCV1 coverage and health system indicators for the six Member States with largest numbers of unimmunized children in 2014**

	MCV1 national coverage rate				Measles incidence per million population				Density of nursing and midwifery personnel per 10 000 population by country (year) <sup>a</sup>
	2014	2013	2012	2010	2014	2013	2012	2010	
Democratic Republic of the Congo	77	76	72	74	486.0	1309.1	1096.2	86.9	5.29 (2004)
Ethiopia	70	62	65	64	132.0	55.8	47.4	48.6	2.53 (2009)
Indonesia	77	84	85	78	48.3	33.7	62.7	78.4	13.83 (2012)
India	83	83	83	82	19.7	11.0	15.1	26.1	17.11 (2011)
Nigeria	51	53	42	56	38.4	304.4	38.2	53.2	16.05 (2008)
Pakistan	63	63	61	69	7.4	48.0	44.9	25.0	5.73 (2010)

<sup>a</sup>As a comparator, global densities of nursing and midwifery personnel as of 2013 were 28.6 per 10 000 population.

Sources:

- JRF (as of 26 June 2015) for incidence rate and WHO-UNICEF estimates for national coverage, 1980–2014, revision July 2015.
- WHO Global Health Workforce statistics database as of July 2015 based on administrative reporting systems, household surveys and population census for density of nursing and midwifery personnel (per 1000 population).



## References

1. Framework for verifying elimination of measles and rubella. *Wkly Epidemiol Rec.* 2013;88(9):89–99.
2. Global Vaccine Action Plan monitoring, evaluation & accountability: Secretariat annual report 2014. Geneva: World Health Organization; 2014 ([http://www.who.int/immunization/global\\_vaccine\\_action\\_plan/gvap\\_secretariat\\_report\\_2014.pdf?ua=1](http://www.who.int/immunization/global_vaccine_action_plan/gvap_secretariat_report_2014.pdf?ua=1), accessed 12 July 2015).
3. Global measles and rubella strategic plan: 2012–2020. Geneva: World Health Organization; 2012 ([http://reliefweb.int/sites/reliefweb.int/files/resources/Measles\\_Rubella\\_StrategicPlan\\_2012\\_2020.pdf](http://reliefweb.int/sites/reliefweb.int/files/resources/Measles_Rubella_StrategicPlan_2012_2020.pdf), accessed 24 November 2014).
4. Wolfson LJ, Strebel PM, Gacic-Dobo M, Hoekstra EJ, McFarland JW, Hersh BS. Has the 2005 measles mortality reduction goal been achieved? A natural history modelling study. *Lancet.* 2007;369:191–200 ([http://www.who.int/immunization/newsroom/final\\_WHO\\_measles\\_paper\\_Lancet.pdf](http://www.who.int/immunization/newsroom/final_WHO_measles_paper_Lancet.pdf), accessed 24 November 2014).
5. Hanvoravongchai P, Mounier-Jack S, Oliveira Cruz V, Balabanova D, Biellik R, Kitaw Y, et al. Impact of measles elimination activities on immunization services and health systems: findings from six countries. *J Infect Dis.* 2011;204 Suppl 1:S82–9. doi: 10.1093/infdis/jir091.
6. Koehlmoos TP, Uddin J, Sarma H. Impact of measles eradication activities on routine immunization services and health systems in Bangladesh. *J Infect Dis.* 2011;204 Suppl 1:S90–7. doi: 10.1093/infdis/jir086.
7. Framework for verifying elimination of measles and rubella, *Wkly Epidemiol Rec.* 2013;88: 89–100.

## Bibliography

- Global progress towards regional measles elimination, worldwide, 2000–2013. *Wkly Epidemiol Rec.* 2014;89(46):509–16.
- Measles & Rubella Initiative annual report 2014. Measles & Rubella Initiative, 2014 ([http://www.measlesrubellainitiative.org/wp-content/uploads/2015/06/MRI-2014-Annual-Report\\_FINAL.pdf](http://www.measlesrubellainitiative.org/wp-content/uploads/2015/06/MRI-2014-Annual-Report_FINAL.pdf), accessed 10 July 2015).
- Meeting of the Strategic Advisory Group of Experts on immunization, November 2013 – conclusions and recommendations. *Wkly Epidemiol Rec.* 2014;89(1):1–20 (<http://www.who.int/entity/wer/2014/wer8901.pdf?ua=1>, accessed 15 December 2014).
- Thapa A, Khanal S, Sharapov U, Swezy V, Sedai T, Dabbagh A, et al. Progress towards measles elimination – South-East Asia Region, 2003–2013. *MMWR Morb Mortal Wkly Rep.* 2015;64(22):613–7.
- Status report on progress towards measles and rubella elimination: SAGE Working Group on measles and rubella. WHO position paper submitted 17 October 2013 ([http://www.who.int/entity/immunization/sage/meetings/2013/november/Status\\_Report\\_Measles\\_Rubella21Oct2013\\_FINAL.pdf?ua=1](http://www.who.int/entity/immunization/sage/meetings/2013/november/Status_Report_Measles_Rubella21Oct2013_FINAL.pdf?ua=1), accessed 15 December 2014).

## GOAL 2: ACHIEVE RUBELLA AND CRS ELIMINATION

(indicator G2.2)

### **Highlights**

- As of December 2014, 140 Member States had introduced rubella vaccines; coverage, however, varies from 12% to 94% depending on region.
- As of the end of 2014, 54 Member States had not introduced rubella-containing vaccine (RCV) into their routine immunization programme. Of those, 42 (78%) are eligible for GAVI Alliance support to introduce RCV.
- Between January 2010 and December 2014, 12 low and middle-income countries (LMIC)<sup>6</sup> introduced an RCV into their national immunization programme. Of these countries, nine (75%) are eligible for GAVI Alliance support.
- The WHO Region of the Americas and the European Region established rubella elimination goals of 2010 and 2015, respectively. The Member States in the Region of the Americas achieved their goal in 2009, one year ahead of the target date. In April 2015, the International Expert Committee (IEC) for Measles and Rubella Elimination in the Americas verified that the Region had eliminated the endemic transmission of rubella and congenital rubella syndrome (CRS).
- In 2014, the European Region reported its lowest ever incidence of rubella (1.0 case per million). While this suggests progress towards the regional elimination goal, it is hard to interpret because the proportion of Member States reporting rubella cases is declining (only 68% of Member States reported rubella cases in 2014). In 2014, the Region was still experiencing a large rubella outbreak in Poland which had started in 2010, putting the 2015 elimination goal at stake.
- The Western Pacific Region has endorsed regional rubella elimination but has not yet set a target date.
- The South-East Asia Region has established a rubella and CRS control goal, linked with its goal to eliminate measles by 2020.
- Two WHO regions (the African Region and the Eastern Mediterranean Region) do not have rubella elimination or control targets.
- Rubella and CRS surveillance systems are weak and cases remain underreported, particularly in Member States that have not yet introduced RCV and/or do not have rubella control or elimination goals. Hence, global rubella and CRS surveillance data do not reflect the true burden of these diseases.
- Failure to fully integrate prevention of rubella and CRS with measles elimination activities represents a major missed opportunity for immunization.

<sup>6</sup> Bangladesh, Cambodia, Cape Verde, Ghana, Lao People's Democratic Republic, Nepal, Philippines, Senegal, Solomon Islands, Morocco, Rwanda, and the United Republic of Tanzania.

<b>DEFINITION OF INDICATOR (1)</b>	<ul style="list-style-type: none"> <li>Rubella and CRS elimination: The absence of endemic rubella virus transmission in a defined geographical area (e.g. region or country) for <math>\geq 12</math> months and the absence of CRS cases associated with endemic transmission in the presence of a well-performing surveillance system</li> </ul> <p><i>Note 1:</i> There may be a time lag (up to 9 months) in occurrence of CRS cases after interruption of rubella virus transmission has occurred. Evidence of the absence of continuing rubella transmission from CRS cases is needed because CRS cases excrete rubella virus for up to 12 months after birth</p> <p><i>Note 2:</i> Verification of rubella elimination takes place after 36 months of interrupted rubella virus transmission</p>
<b>DATA SOURCES</b>	<ul style="list-style-type: none"> <li>WHO-UNICEF joint reporting forms (JRFs) for disease incidence and WHO-UNICEF Estimates of National Immunization Coverage (WUENIC) data for coverage rates are subject to the same limitations as all other data submitted via the JRFs, as described in the 2014 report of the GVAP Secretariat (2)</li> <li>There are no WHO-UNICEF estimates for rubella coverage. The first dose of measles-containing vaccine (MCV1) is used as a proxy in the Member States that have introduced rubella vaccine (as all the Member States use combined vaccines for first dose of rubella except for the Russian Federation).</li> </ul>
<b>COMMENTS ON DATA QUALITY</b>	<ul style="list-style-type: none"> <li>None</li> </ul>
<b>MILESTONES</b>	<ul style="list-style-type: none"> <li>Americas: Rubella eliminated in 2009 and the International Expert Committee verified the Region as rubella and CRS free in April 2015</li> <li>European: Rubella elimination by 2015</li> <li>Western Pacific: Rubella elimination but no target date</li> <li>South-East Asia: Rubella control by 2020</li> <li>African: No target</li> <li>Eastern Mediterranean: No target</li> </ul>

### ***Background and progress***

As of December 2014, 140 (72%) Member States had introduced RCV, a 49% (46 countries) increase from 2000 (Figure 11 and Figure 12). Average coverage globally has gradually increased from 41% in 2010 to 46% in 2014. However, it varies from 12% in the South-East Asia Region to 94% in the European Region (Table 9). In 2014, an additional three Member States introduced rubella vaccine in their routine programme (Morocco, Rwanda and the United Republic of Tanzania). Introduction of rubella vaccine is ongoing in six Member States (Burkina Faso, Cameroon, Myanmar, Viet Nam, Yemen, Zimbabwe), and two Member States (Ethiopia and Papua New Guinea) plan to introduce the vaccine in 2016.

In 2014, the global incidence of rubella was estimated to be 4.6 per million population (reported by 158 Member States, Table 9 and Figure 13). Note that the total number of Member States reporting rubella incidence to WHO has diminished dramatically in recent years, from 176 (91%) in 2012 to

158 (81%) Member States in 2014, which explains the appearance that rubella incidence is diminishing.

The same trend can be seen with CRS reporting. In total 111 (57%) Member States reported CRS figures in 2014 compared with 130 (67%) in 2012 (Table 10). The very low reported incidence is probably more a sign of the almost non-existent CRS surveillance systems outside the Americas and a few other Member States than a reflection of true disease burden.

The **Region of the Americas** achieved its 2010 elimination goal in 2009 and very few cases of rubella and CRS have been reported in the region since then. Between 2010 and 2014, 56 imported rubella cases were reported in eight countries: Argentina (4), Brazil (1), Canada (19), Chile (1), Colombia (2), Mexico (2) and the United States (27). Regarding CRS, five imported cases were reported in Canada (1 in 2011) and the United States (3 in 2012 and 1 in 2013). In 2015, the region was verified as having eliminated rubella and CRS.

All 53 Member States in the **European Region** use the combined measles, mumps and rubella (MMR) vaccine in a two-dose schedule. Based on JRF data, the number of rubella cases reported in the region dropped by 98% between 2013 (n = 39614) and 2014 (n = 640). However, only 19 countries in the Region reported rubella cases in the 2015 JRF. Most of the cases occurred in Poland even though no cases were reported in JRF. Regional sources<sup>7</sup> reported around 5899 rubella cases in Poland in 2014. Countries that reported cases in JRF include Kazakhstan (n = 152), Germany (n = 151), and Georgia (n = 149).

The large decrease in cases reported in 2014 is primarily the result of a decrease in cases reported by Poland, despite lack of a response measure to control the outbreak. The outbreak in Poland started in 2010 and was caused by aggregation of susceptible cohorts in the context of gender-specific immunization in the past, and late introduction of the two-dose MMR schedule. The outbreak mostly affected adolescent/young adult men, with 37% of those affected by rubella being 15 years of age and older.

In 2014, the **Regional Committee for the Western Pacific** endorsed the Regional Framework for Implementation of the Global Vaccine Action Plan in the Western Pacific and its specified immunization goals, including the regional rubella elimination goal (target date to be determined). At the regional meeting of the Technical Advisory Group (TAG) in June 2015, a recommendation was made to establish 2020 as the target date for elimination of rubella in the region; this recommendation will be discussed by Member States at the next Regional Committee Meeting. The number of reported rubella cases has been declining in the Western Pacific Region since 2011 (from 76 022 in 2011 to 12 814 in 2014) with the majority of cases being reported from China and Japan. Reported CRS cases have also declined in the region (44 in 2013 and 12 in 2014) with most cases being reported from China. CRS surveillance is either weak or is not carried out by many countries in the region.

Six of the 11 countries in the **South-East Asia Region** had introduced RCV by the end of 2014; the remaining five countries are home to approximately 33 million (87%) of the 38 million children under 1 year of age. However, all five of these countries have committed to introducing the vaccine in the next few years. In 2014, 9263 confirmed cases of rubella were reported. India continued to report the most confirmed cases (4870), followed by Indonesia (3267) and Nepal (704). Surveillance for CRS

---

<sup>7</sup> These data are available at

[http://www.euro.who.int/\\_data/assets/pdf\\_file/0004/276115/EpiData-No12-2014.pdf?ua=1](http://www.euro.who.int/_data/assets/pdf_file/0004/276115/EpiData-No12-2014.pdf?ua=1)

only started as a WHO-supported activity after the September 2013 Regional Committee resolution and all countries in the region have agreed in principle to establish sentinel surveillance for CRS.

Although the **Eastern Mediterranean Region** has not yet set a rubella elimination goal, 13 countries (60%) have set a national target for rubella/CRS elimination and 10 countries are now implementing CRS surveillance. In 2014, 2945 confirmed cases of rubella were reported by the countries of the Eastern Mediterranean Region, the majority of these (95%) were reported from four countries (Afghanistan, Pakistan, Sudan and Yemen) which had not yet introduced RCV.<sup>8</sup> So far, only one of the six GAVI-eligible countries (i.e. Yemen) has benefited from GAVI support to conduct supplementary immunization activities (SIAs) of RCV with introduction planned in 2015.

**The African Region** does not have a rubella control or elimination target and, in 2014, reported the highest incidence of rubella of all WHO regions. This is not surprising given the low uptake of RCV in the region. By the end of 2014, seven (15%) of the countries had introduced RCV. Of these, four countries are GAVI eligible.

A new phase of accelerated rubella control and CRS prevention has begun, marked by the 2011 WHO Position Paper, which recommended a strategy consistent with rubella and CRS elimination (3), the inclusion of rubella elimination in five WHO regions by 2020 as a disease control target in the Global Vaccine Action Plan (2012), and GAVI support for the introduction of rubella vaccine in countries meeting the eligibility criteria.

The key challenges are:

- a) building support for additional regions to adopt elimination goals. This includes ensuring that all Member States can achieve and maintain the minimum coverage ( $\geq 80\%$ ) through routine services and/or in SIAs required for introduction of RCV;
- b) advocating for resources and a secure vaccine supply needed to meet the European Region's elimination goal;
- c) ensuring high routine coverage of RCV (because of the use of combined measles and rubella-containing vaccines (MR) or measles, mumps and rubella-containing (MMR) vaccines, the programmatic target for RCV1 and RCV2 coverage is  $\geq 95\%$ );
- d) ensuring high-quality MR SIAs that reach at least 95% of targeted children, as verified through surveys; and
- e) strengthening synergies between rubella and measles surveillance and expanding CRS surveillance – commitment at all levels of government as well as involvement of the private sector is needed to address these challenges.

For GAVI-eligible countries, the challenge is in capitalizing on the available resources for RCV introduction while ensuring sufficient political and financial commitment to assure the sustainability of the programme.

Financial support from the GAVI Alliance together with the leadership, coordination and technical expertise from the Measles & Rubella Initiative (M&RI), provide an opportunity for Member States and regions to accelerate progress in rubella control and CRS prevention. However, except for the Americas, the WHO regions are not on track to achieve elimination. Substantially greater

---

<sup>8</sup> Yemen, with GAVI support, conducted a nationwide MR campaign for children aged from 9 months to 14 years in November 2014 and subsequently introduced RCV in February 2015.

commitment and investment by Member States and the global immunization community will be required to complete the task of rubella elimination in the European Region by 2015 and to reach the GVAP target of rubella elimination in five regions by 2020.

Table 9 and Table 10 and Figure 11-13 provide data on cases of rubella and CRS.

**Table 9: Rubella cases and incidence by WHO region, 2012–2014**

WHO region	National rubella coverage (%)			Member States reporting rubella cases (%)			Rubella incidence per million population		
	2014	2013	2012	2014	2013	2012	2014	2013	2012
African Region	10.3	3.5	0.1	94	91	87	7.9	15.3	13.0
Region of the Americas	91.9	91.3	94	94	97	100	0	0	0
Eastern Mediterranean Region	41.7	37.7	37.9	90	86	90	4.8	6.7	3.0
European Region	94.2	94.8	94.6	68	79	89	1.0	63.4	42.3
South-East Asia Region	12.1	12.2	10.8	91	100	100	5.1	5.6	3.8
Western Pacific Region	91.3	91.3	89.3	59	63	85	6.9	18.3	24.1
<b>Total</b>	<b>45.7</b>	<b>43.8</b>	<b>42.3</b>	<b>81</b>	<b>85</b>	<b>91</b>	<b>4.9</b>	<b>14.2</b>	<b>13.4</b>

*Note:* MCV1 was used as a proxy in the Member States that have introduced rubella vaccine.

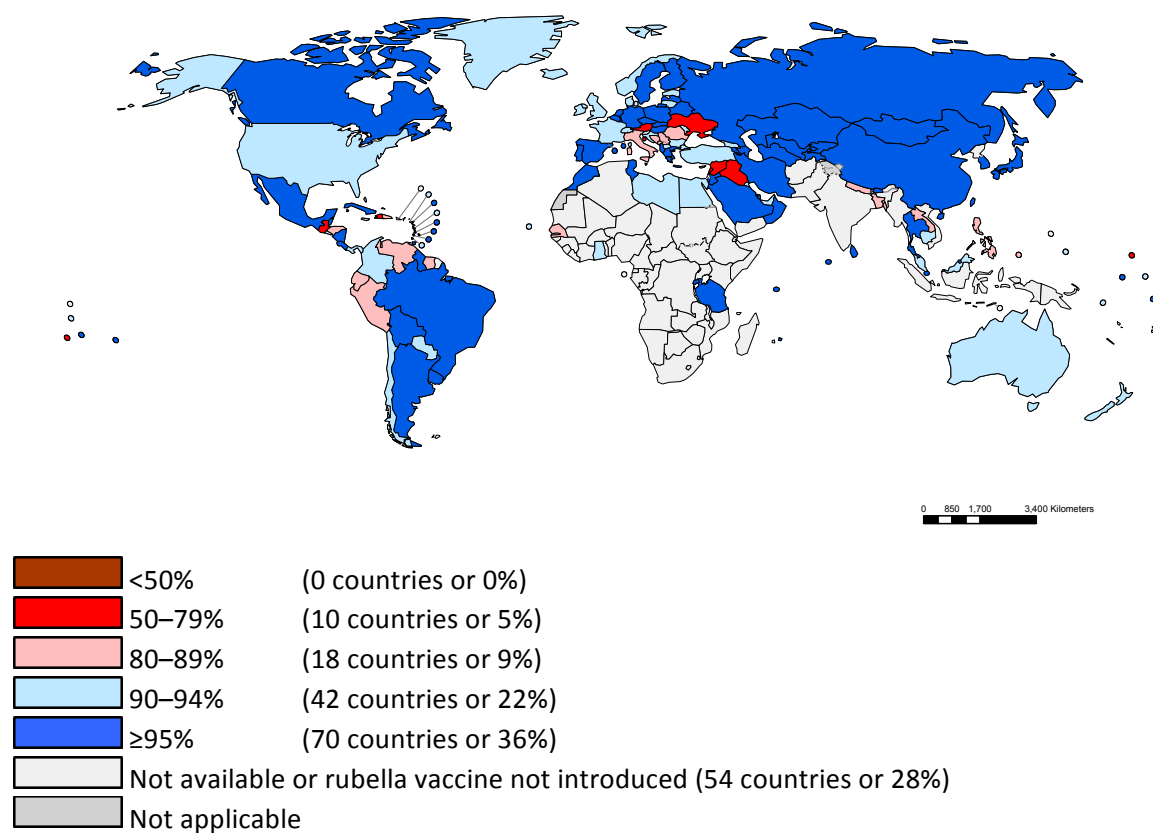
Source: JRF (as of 26 June 2015) and WHO-UNICEF estimates, 1980–2014, revision July 2015.

**Table10: CRS cases and incidence by region, 2010–2014**

WHO region	CRS incidence per million population			Member States reporting CRS cases (%)		
	2014	2013	2012	2014	2013	2012
African Region	0.08	0.03	0.34	36	34	43
Region of the Americas	0	0	0	94	97	100
Eastern Mediterranean Region	0.01	0.06	0.15	38	52	43
European Region	0.04	0.07	0.09	64	81	81
South-East Asia Region	0.37	0.08	0.12	64	55	55
Western Pacific Region	0.04	0.13	0.39	44	48	63
<b>Total</b>	<b>0.06</b>	<b>0.02</b>	<b>0.04</b>	<b>57</b>	<b>63</b>	<b>67</b>

Source: JRF (data as of 26 June 2015).

**Figure 11: Immunization coverage with rubella-containing vaccines<sup>a</sup> in infants, 2014**



<sup>a</sup> MCV1 was used as a proxy in the Member States that have introduced rubella vaccine.

Map production: Immunization Vaccines and Biologicals (IVB), World Health Organization.

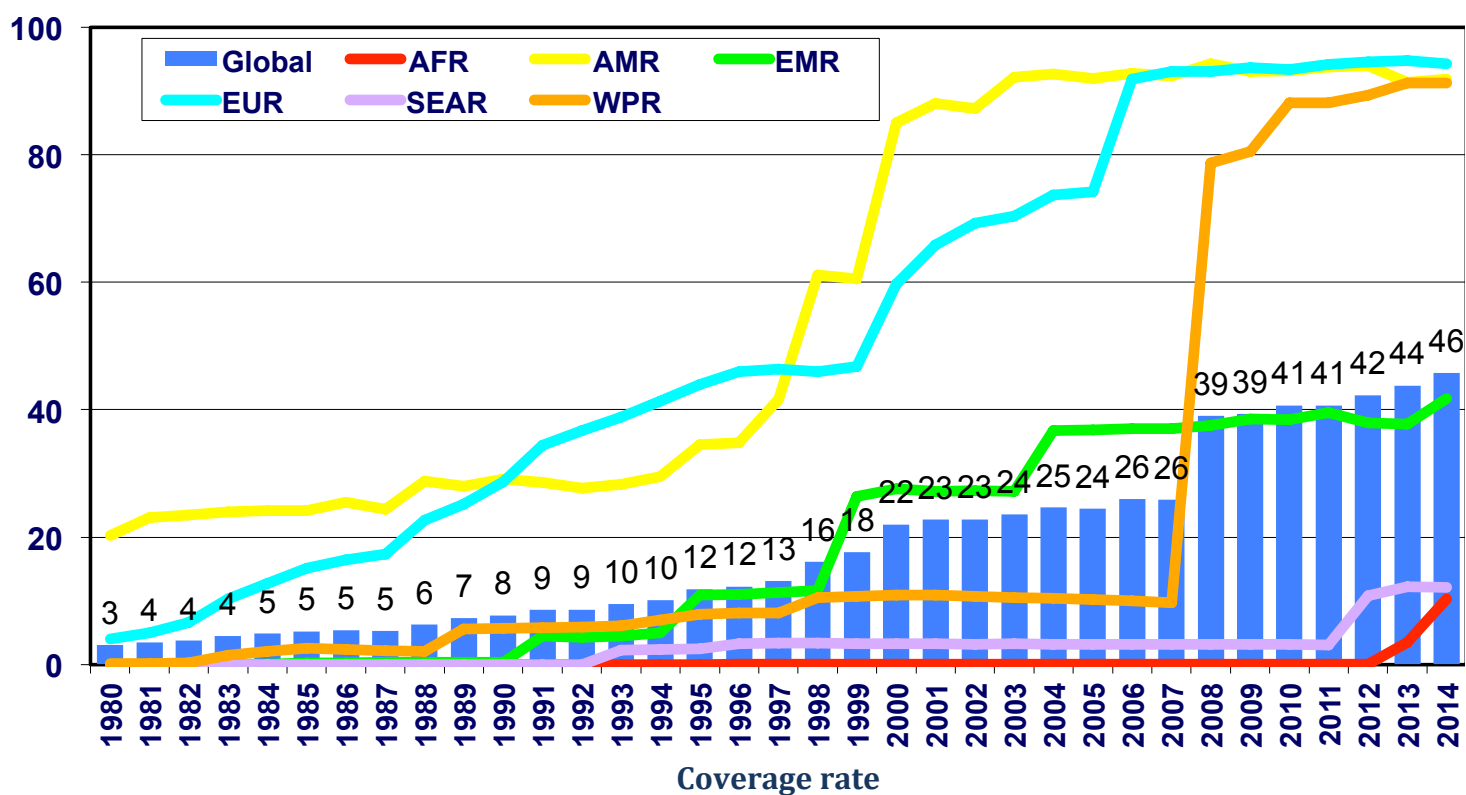
Date of slide: 17 July 2015.

Source: WHO, UNICEF coverage estimates 2015 revision, July 2015.

© WHO 2015. All rights reserved.

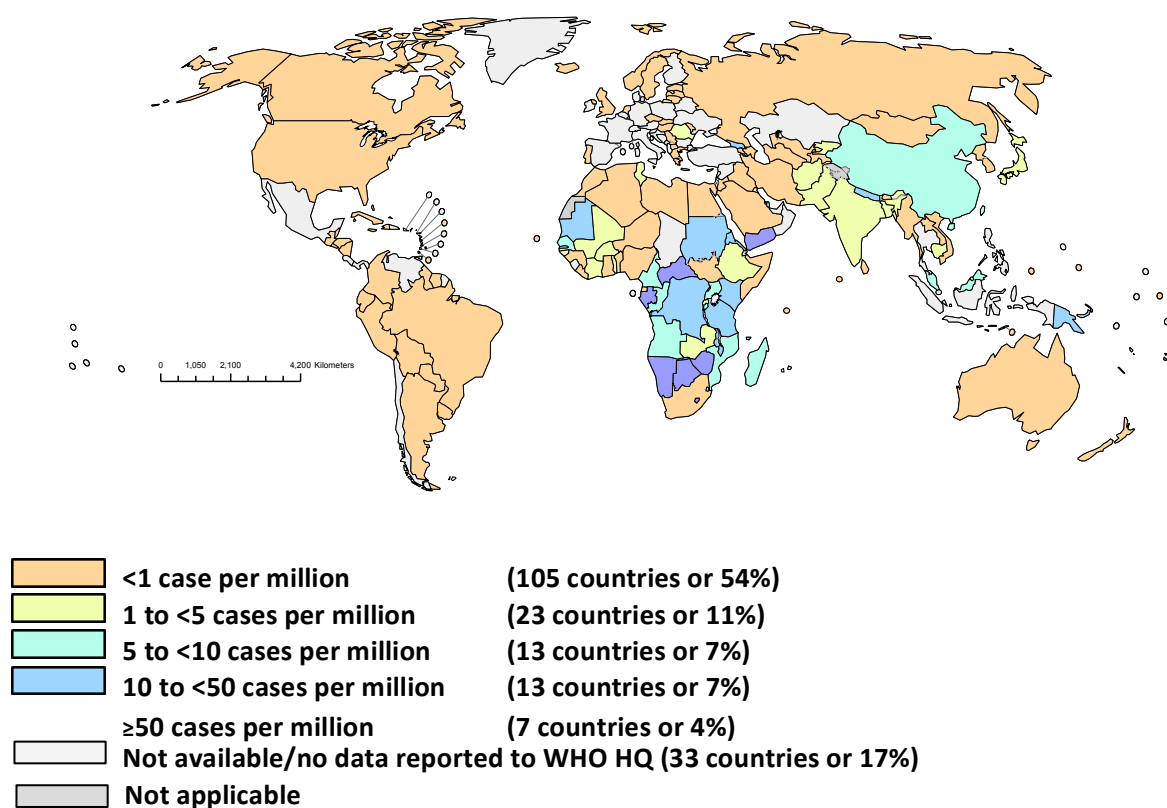


Figure 12: Rubella-containing vaccine coverage<sup>a</sup> by WHO region, 1980–2014



<sup>a</sup> MCV1 was used as a proxy in the Member States that have introduced rubella vaccine. Immunization Vaccines and Biologicals (IVB), WHO. 194 WHO Member States. Date of slide: 16 July 2015. Source: WHO-UNICEF coverage estimates 2015 revision, July 2015.

**Figure 13: Reported rubella incidence rate per country for 2014<sup>a</sup>**



<sup>a</sup>Per million population.

Map production: Immunization Vaccines and Biologicals (IVB), WHO. Date of slide: 16 July 2015.

Source: Joint Reporting Form as at 26 June 2015: 194 WHO Member States. Map production: Immunization Vaccines and Biologicals (IVB), WHO.

© WHO 2015. All rights reserved.

## References

1. Framework for verifying elimination of measles and rubella. Wkly Epidemiol Rec. 2013;88(9):89–99.
2. Global Vaccine Action Plan monitoring, evaluation & accountability: Secretariat annual report 2014. Geneva: World Health Organization; 2013 ([http://www.who.int/immunization/global\\_vaccine\\_action\\_plan/gvap\\_secretariat\\_report\\_2014.pdf?ua=1](http://www.who.int/immunization/global_vaccine_action_plan/gvap_secretariat_report_2014.pdf?ua=1), accessed 12 July 2015).
3. Rubella vaccines: WHO Position Paper. Wkly Epidemiol Rec. 2011;86 (29):301–16 (<http://www.who.int/wer/2011/wer8629.pdf?ua=1>, accessed 12 July 2015).

## Bibliography

- Measles and Rubella Initiative annual report 2014. Measles & Rubella Initiative, 2014 ([http://www.measlesrubellainitiative.org/wp-content/uploads/2015/06/MRI-2014-Annual-Report\\_FINAL.pdf](http://www.measlesrubellainitiative.org/wp-content/uploads/2015/06/MRI-2014-Annual-Report_FINAL.pdf), accessed 10 July 2015).

- Meeting of the Strategic Advisory Group of Experts on immunization, November 2013 – conclusions and recommendations. Wkly Epidemiol Rec. 2014;89(1):1–20 ([http://www.who.int/entity/wer/2014/wer8901.pdf?ua = 1](http://www.who.int/entity/wer/2014/wer8901.pdf?ua=1), accessed 31 July 2015).
- Rubella and congenital rubella syndrome control and elimination – global progress, 2012. Wkly Epidemiol Rec. 2013;88(49):521–32 (<http://www.who.int/entity/wer/2013/wer8849/en/index.html>, accessed 31 July 2015).
- Status report on progress towards measles and rubella elimination: SAGE Working Group on measles and rubella, 2013 ([http://www.who.int/entity/immunization/sage/meetings/2013/november/Status\\_Report\\_Measles\\_Rubella21Oct2013\\_FINAL.pdf?ua = 1](http://www.who.int/entity/immunization/sage/meetings/2013/november/Status_Report_Measles_Rubella21Oct2013_FINAL.pdf?ua=1), accessed 31 July 2015).