



**XI International Symposium for Latin American experts**  
Organized by: Fondation Mérieux and the Latin American Society  
for Pediatric Infectious Diseases (SLIPE)

# **The Resurgence the Case of Diphtheria and Measles, the Role of the Vaccines**

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**Costa Rica**  
**2018**



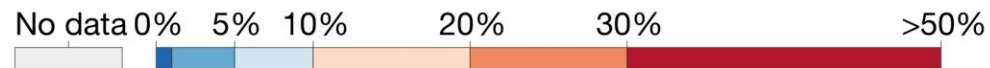
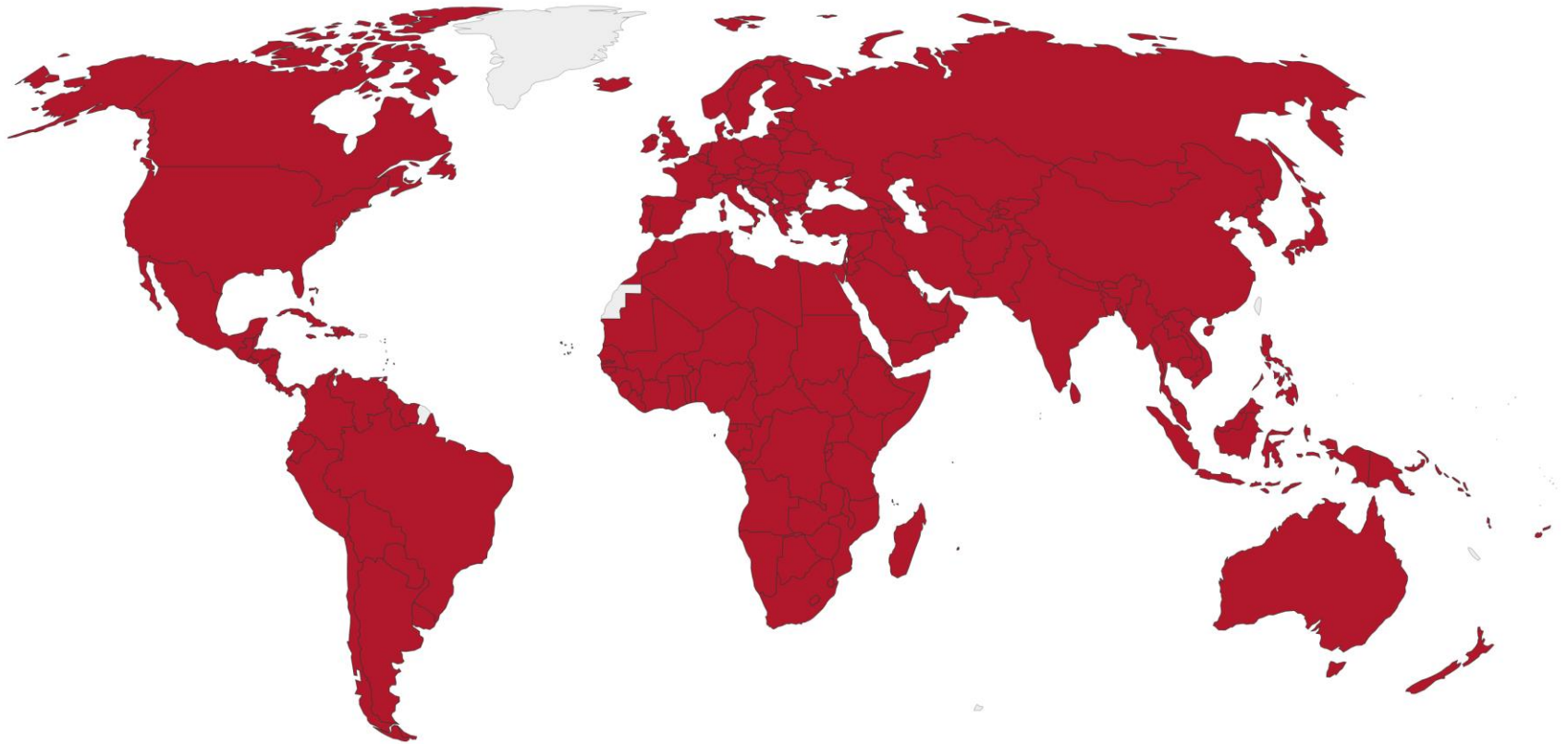
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**Conflicts of interest  
None.**



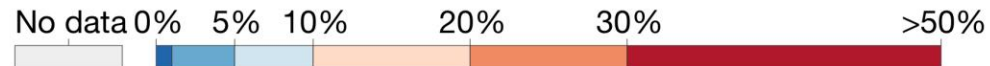
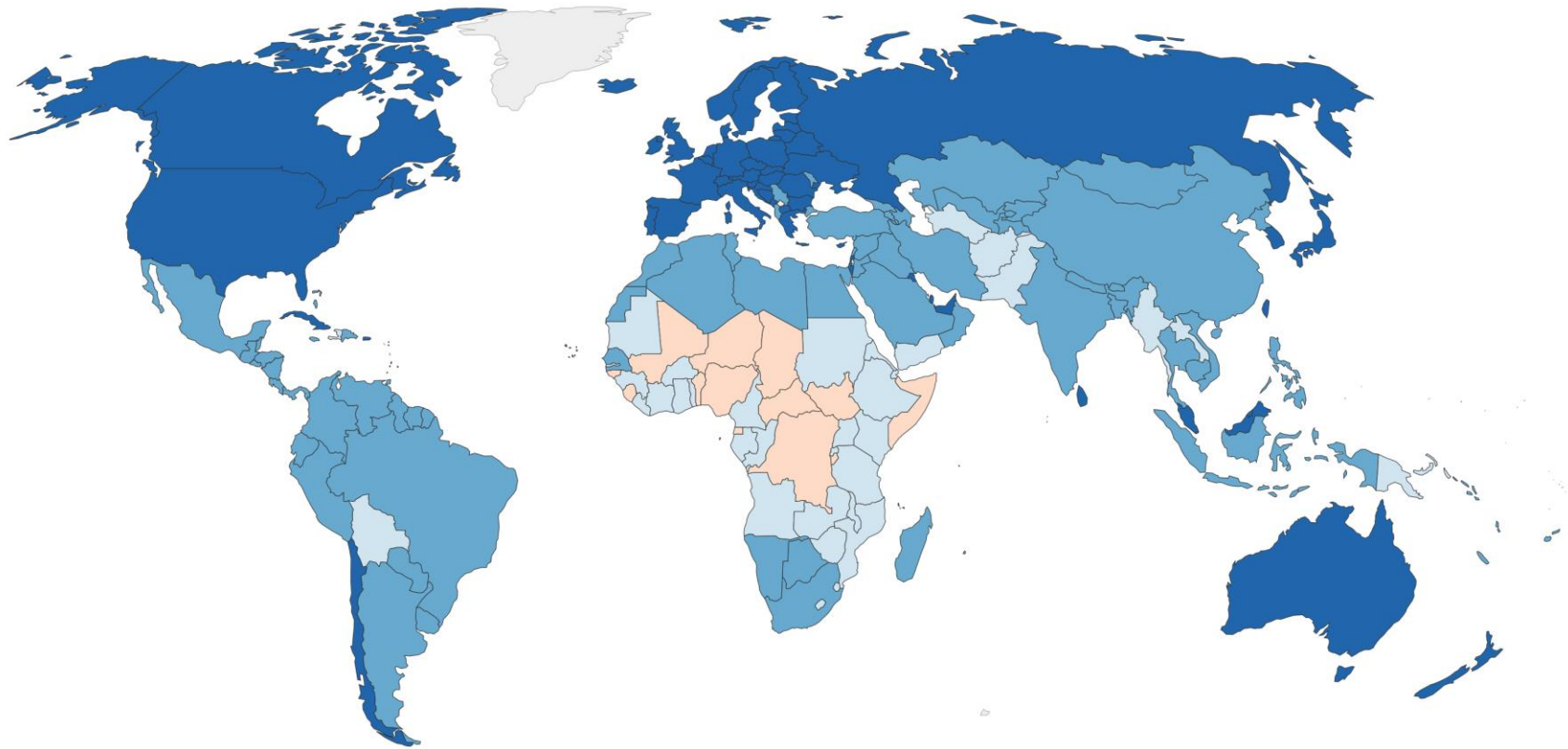
# Child mortality rate, 1800

Shown is the share of children (born alive) who die before they are five years old.



# Child mortality rate, 2015

Shown is the share of children (born alive) who die before they are five years old.



# Causes of child mortality in 2013 and annual rate of reduction since 2000

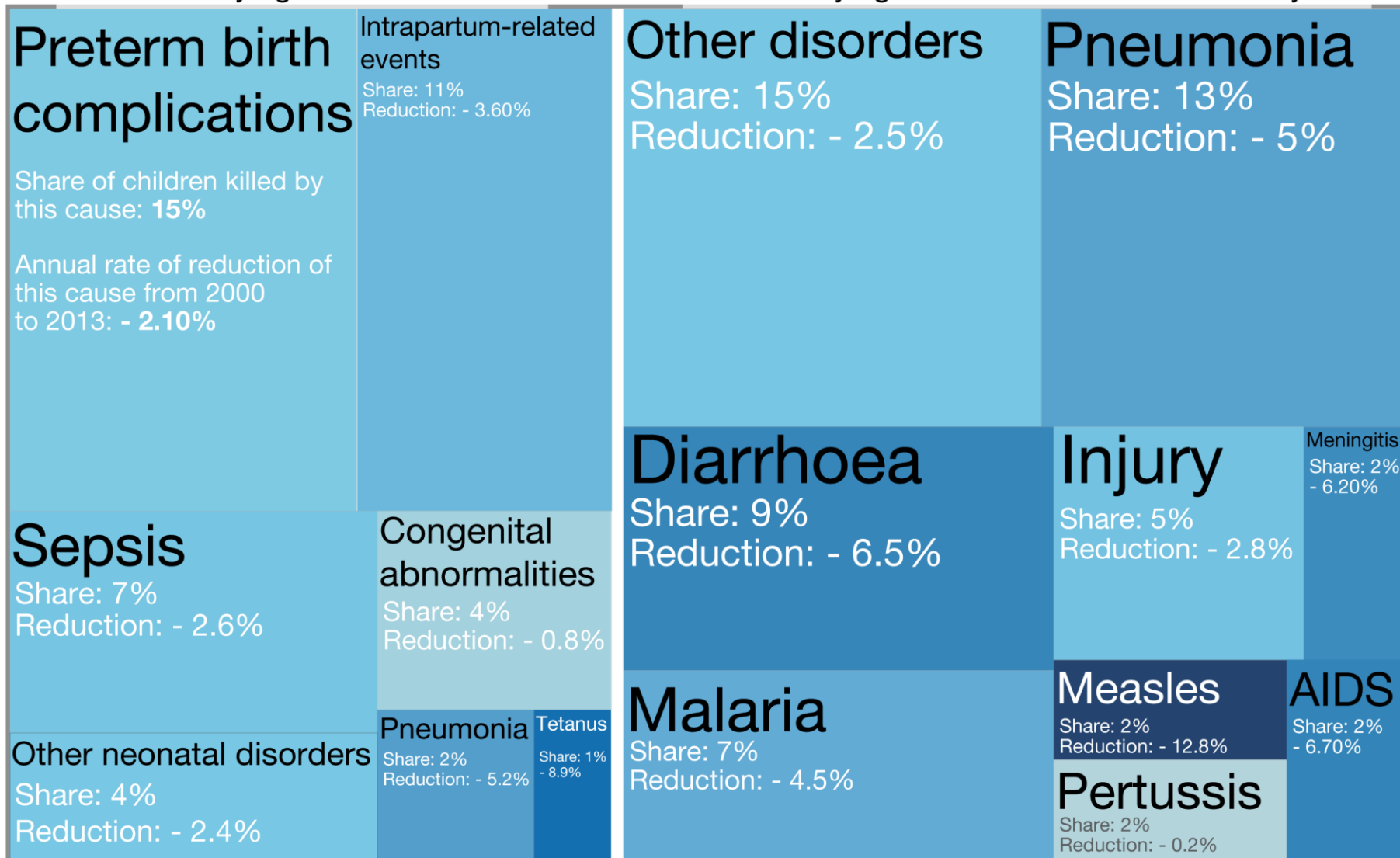
6.3 million children died before the age 5 years in 2013 (44% of which died in the first month of their life). In 2000 9.9 million children died.

– The size of the rectangle shows the share of children killed by each cause

– The color indicates the annual reduction of that cause since 2000 (child mortality from all causes declined). -0.2%  -12.8%

## Newborns dying in their 1<sup>st</sup> month

## Children dying after 1<sup>st</sup> month and before 5 years



# Measles



# Region of the Americas is declared free of measles

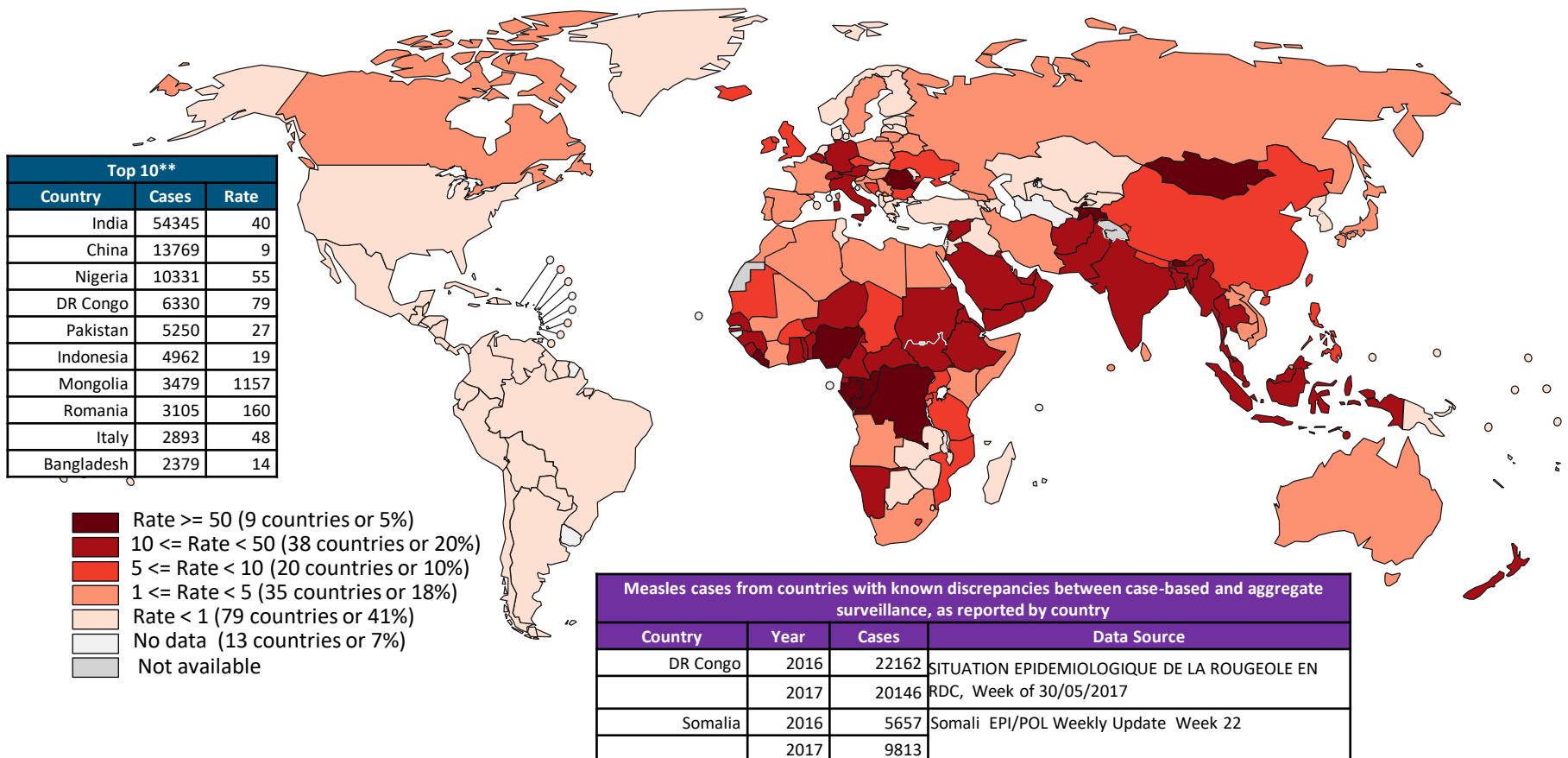
Washington, D.C., 27 September 2016 (PAHO/WHO) - The Region of the Americas is the first in the world to have eliminated measles, a viral disease that can cause severe health problems, including pneumonia, brain swelling and even death. This achievement culminates a 22-year effort involving mass vaccination against measles, mumps and rubella throughout the Americas.

The declaration of measles' elimination was made by the International Expert Committee for Documenting and Verifying Measles, Rubella, and Congenital Rubella Syndrome Elimination in the Americas. The announcement came during the 55<sup>th</sup> Directing Council of the Pan American Health Organization/World Health Organization (PAHO/WHO), which is currently underway and is being attended by ministers of Health from throughout the Americas.

Measles is the fifth vaccine-preventable disease to be eliminated from the Americas, after the regional eradication of smallpox in 1971, poliomyelitis in 1994, and rubella and congenital rubella syndrome in 2015.

# Measles Incidence Rate per Million by Countries, May 2016-April 2017.

0 875 1750 3500 Kilometers



Based on data received 2017-06 and covering the period between 2016-05 and 2017-04 - Incidence: Number of cases / population\* \* 100,000 - \* World population prospects, 2015 revision - \*\* Countries with the highest number of cases for the period - Data source: IVB Database - Map production: IVB/EPI World Health Organization, WHO, 2017. All rights reserved





# Global and regional immunization profile



Data received as of  
2018-Sep-18

## Region of the Americas

Next overall update spring 2019  
Next WHO UNICEF estimates July 2019

### Population data in thousands <sup>1</sup>

	2017	2016	2015	2014	2013
<b>Total population</b>	1'001'309	992'157	982'903	973'565	964'141
<b>Live births</b>	15'109	15'125	15'140	15'160	15'188
<b>Surviving infants</b>	14'912	14'921	14'929	14'943	14'963
<b>Pop. less than 5 years</b>	74'725	74'755	74'921	75'107	75'357
<b>Pop. less than 15 years</b>	226'910	227'376	227'954	228'718	229'526
<b>Female 15-49 years</b>	253'763	252'188	250'555	248'921	247'225

### Number of reported cases

<b>Diphtheria</b>	872	45	49	10	5
<b>Japanese encephalitis</b>	-	-	-	-	-
<b>Measles</b>	775	12	611	1'966	491
<b>Mumps</b>	46'730	21'142	19'115	18'377	16'747
<b>Pertussis</b>	10'232	10'160	32'116	46'865	54'873
<b>Polio</b>	0	0	0	0	0
<b>Rubella</b>	0	1	5	10	11
<b>Rubella (CRS)</b>	0	0	2	0	1
<b>Tetanus (neonatal)</b>	13	11	22	10	20
<b>Tetanus (total)</b>	512	499	568	517	485
<b>Yellow fever</b>	823	113	37	23	26



# Global and regional immunization profile



Data received as of  
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## Region of the Americas

Next overall update spring 2019  
Next WHO UNICEF estimates July 2019

	2017	2016	2015	2014	2013
<b>Percentage of target population vaccinated, by antigen</b>					
<i>based on WHO-UNICEF estimates</i>					
<i>TT2plus is based on reported coverage</i>					
<b>BCG</b>	92	93	96	96	94
<b>DTP1</b>	96	96	96	95	95
<b>DTP3</b>	91	91	91	90	91
<b>HepB_BD</b>	69	65	69	67	66
<b>HepB3</b>	90	90	89	88	89
<b>Hib3</b>	91	91	91	90	91
<b>IPV1</b>	93	84	62	-	-
<b>MCV1</b>	92	92	92	92	92
<b>MCV2</b>	74	80	53	54	45
<b>PCV3</b>	82	82	85	83	79
<b>Pol3</b>	90	87	91	90	89
<b>RCV1</b>	92	92	92	92	92
<b>TT2plus</b>	60	71	48	54	69
<b>YFV</b>	60	53	56	57	56

# Epidemiological Update Measles

21 September 2018

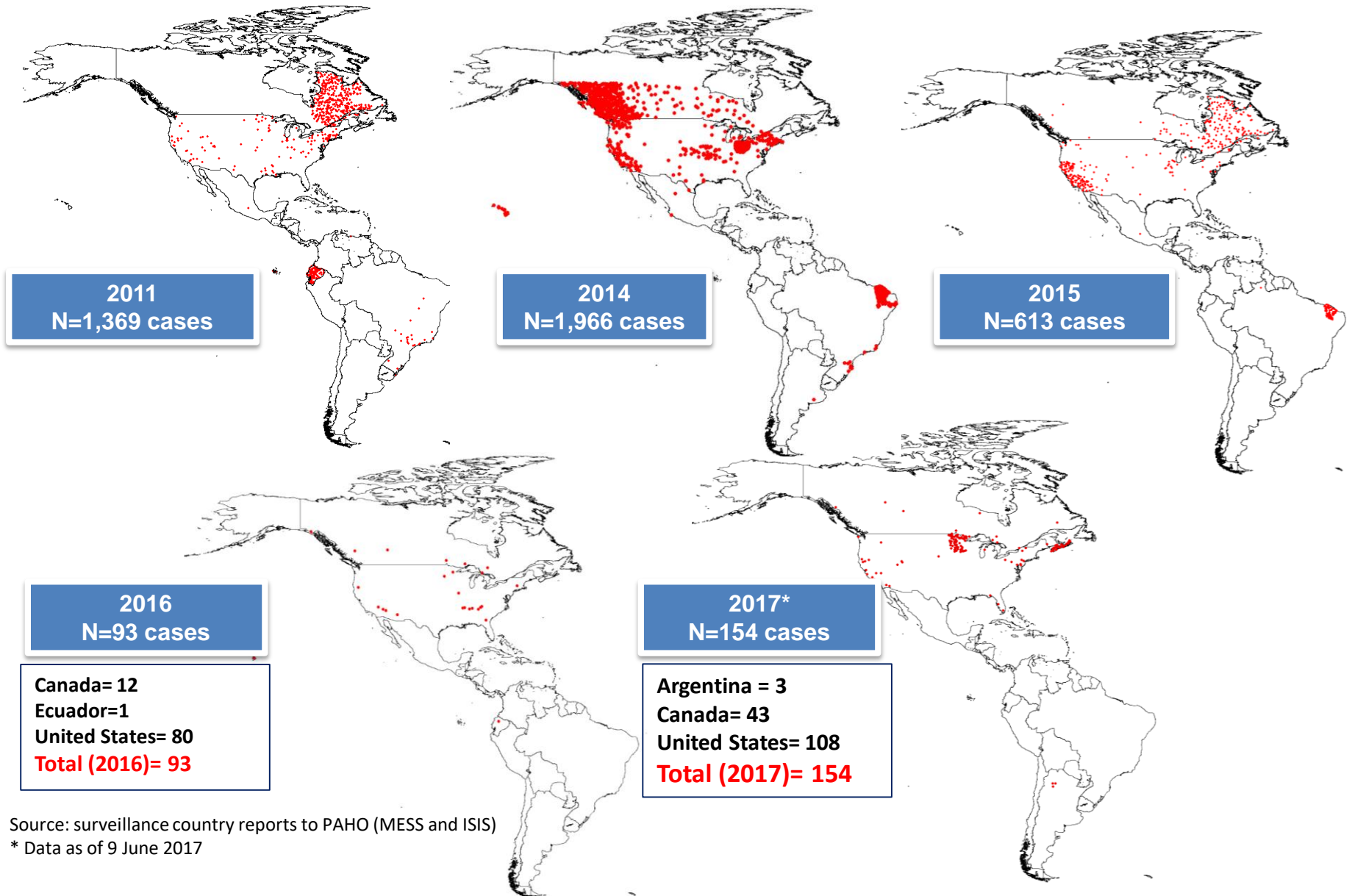
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## Situation Summary

In 2018, as of 21 September, a total of 6,629 confirmed cases of measles, including 72 deaths, have been reported in 11 countries of the Region of the Americas: Antigua and Barbuda (1 case), Argentina (11 cases), Brazil (1,735 cases, including 10 deaths), Canada (22 cases), Colombia (85 cases), Ecuador (19 cases), Guatemala (1 case), Mexico (5 cases), Peru (21 cases), the United States of America (124 cases), and the Bolivarian Republic of Venezuela (4,605 cases, including 62 deaths).

Since the 20 August 2018 Epidemiological Update on measles<sup>1</sup>, a total of 1,625 additional confirmed measles cases were reported, including 4 deaths in 8 countries of the Region (3 cases in Argentina, 498 cases and 4 new deaths in Brazil, 3 cases in Canada, 25 cases in Colombia, 2 cases in Ecuador, 17 cases in Peru, 17 cases in the United States, and 1,060 cases in Venezuela).

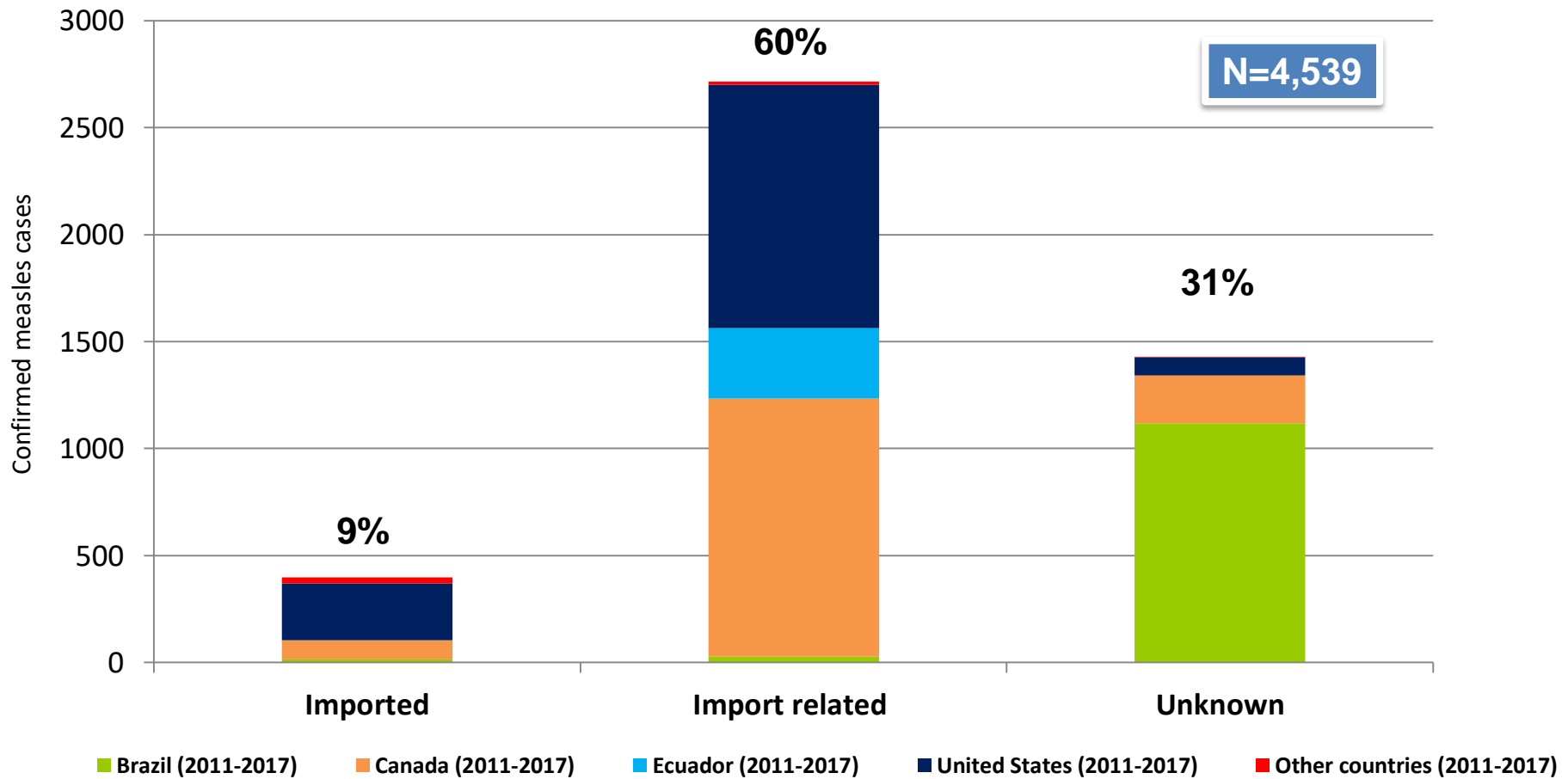
# Measles cases by countries in selected years\*, The Americas.



Source: surveillance country reports to PAHO (MESS and ISIS)

\* Data as of 9 June 2017

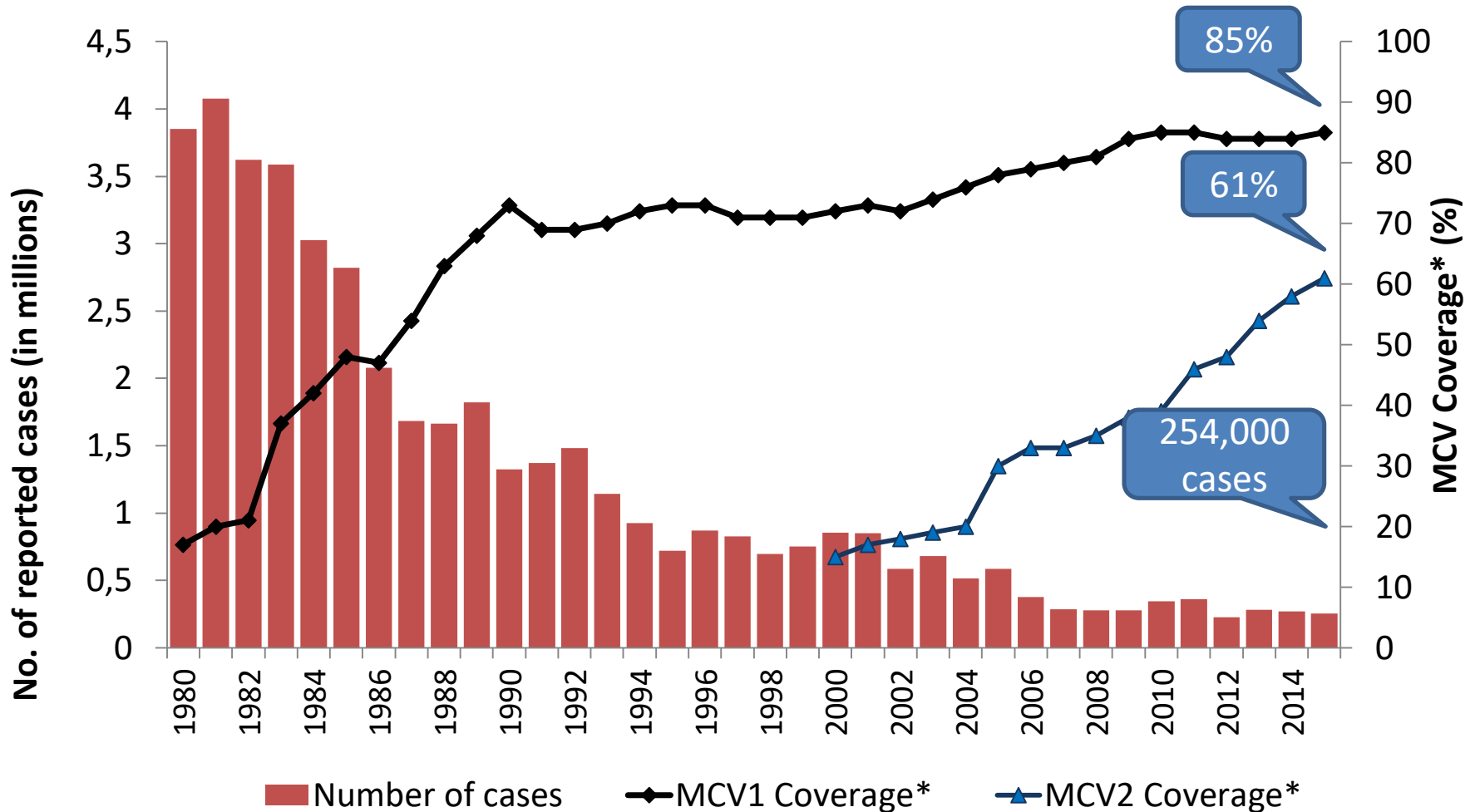
# Measles cases by infection source, The Americas, 2011-2017\*.



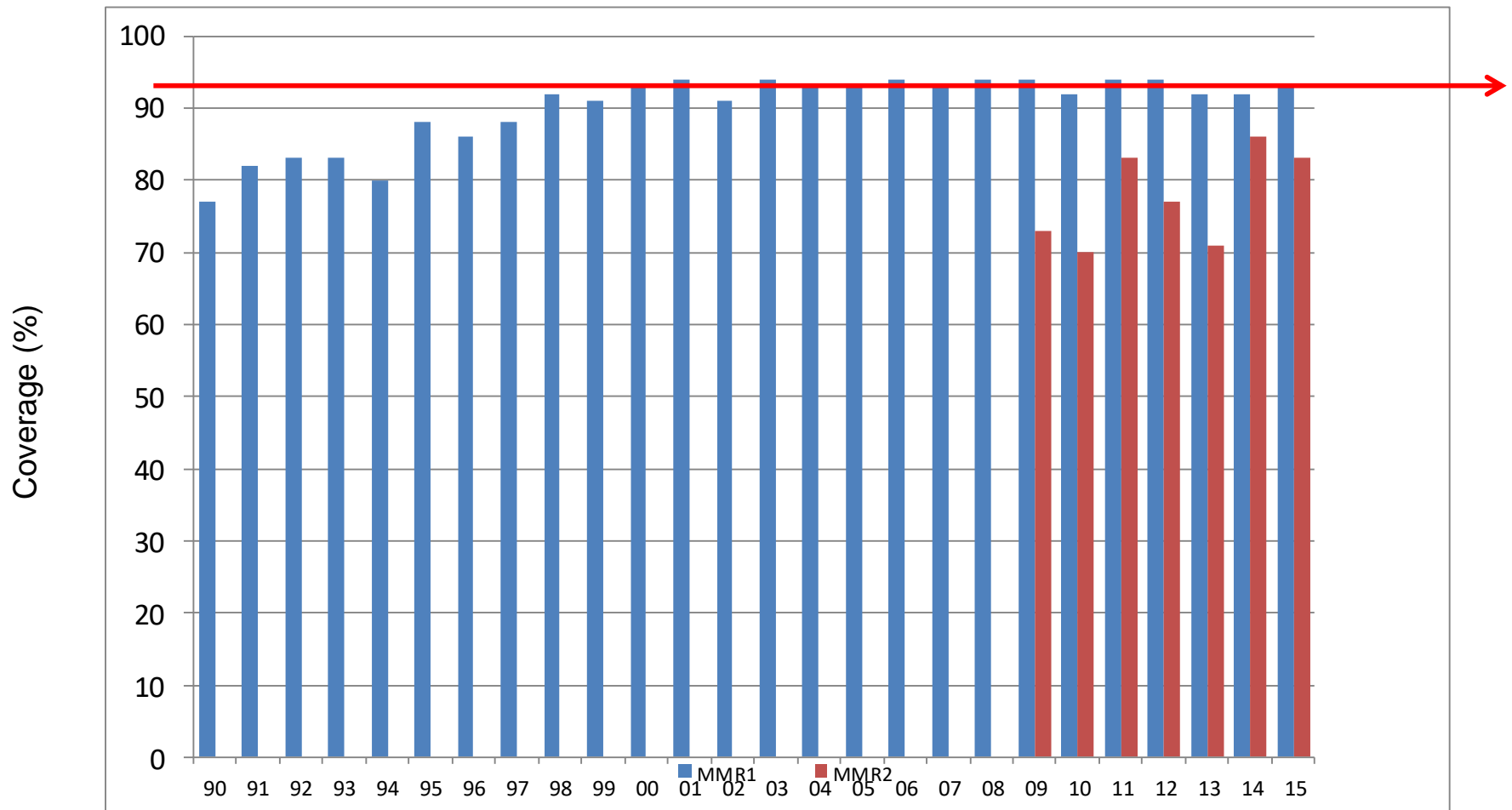
Source: ISIS, MESS and country reports.

\*Data as of epidemiological week 24, 2017.

# Annual reported measles cases and MCV1 and MCV2\*\* coverage\*, 1980-2015.



# MMR1 and MMR2 vaccination coverage, The Americas, 1990-2015.

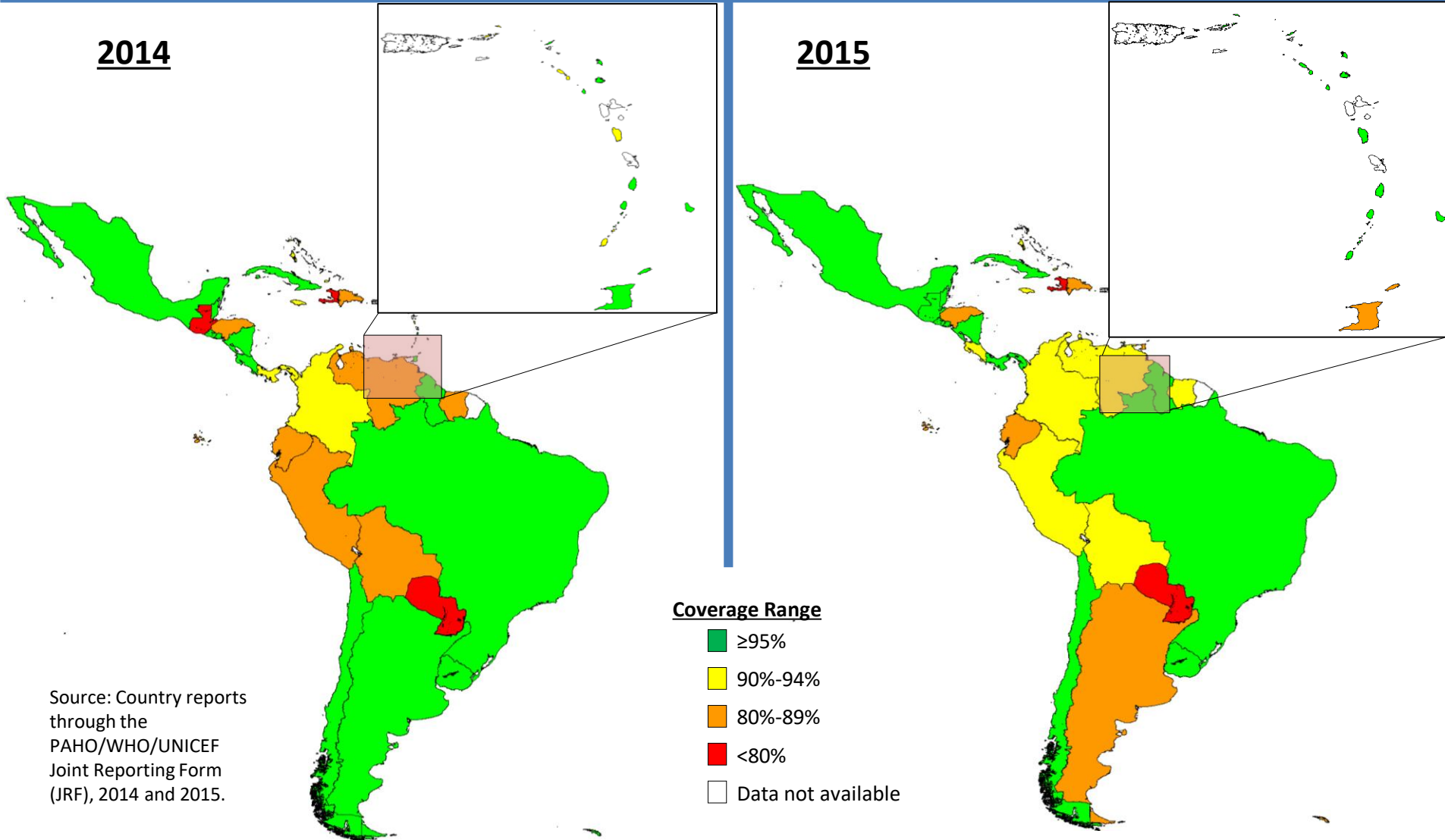


Source: Country report through the PAHO-WHO/UNICEF Joint Reporting Forms (JRF), 2016.

# MMR1 coverage by countries in children 1 year of age, Latin America and the Caribbean, 2014-2015.

**2014**

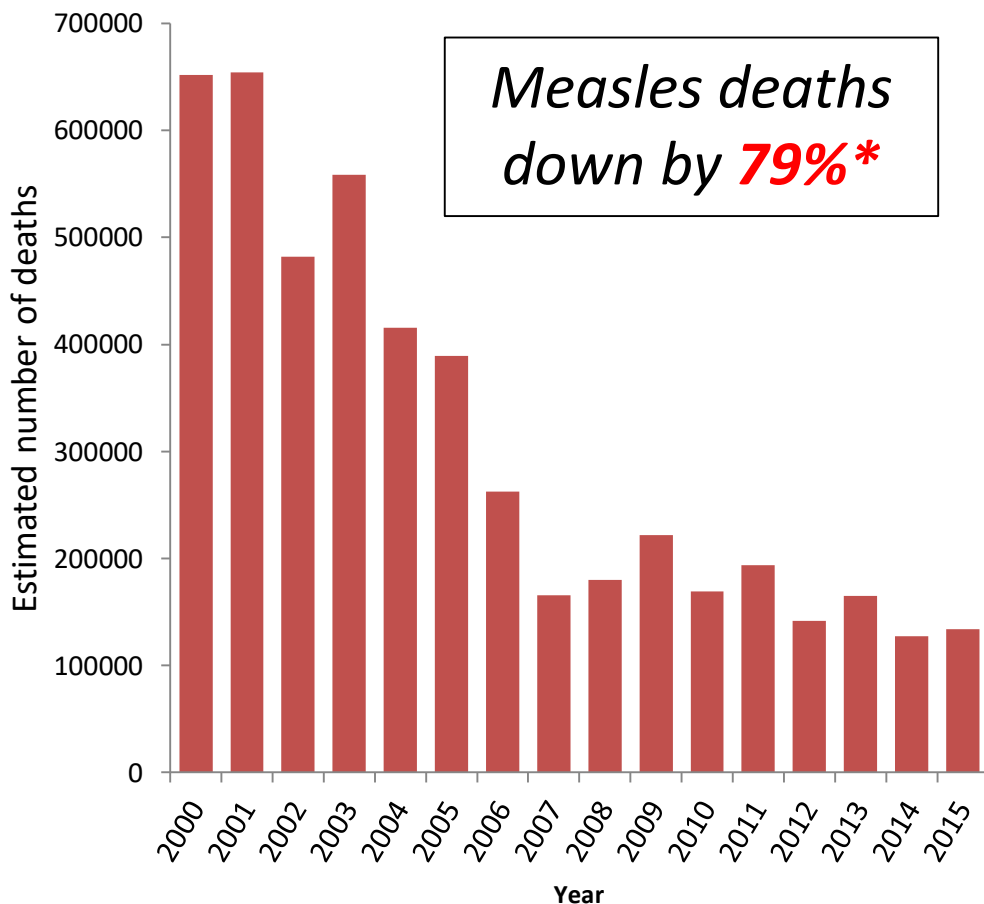
**2015**



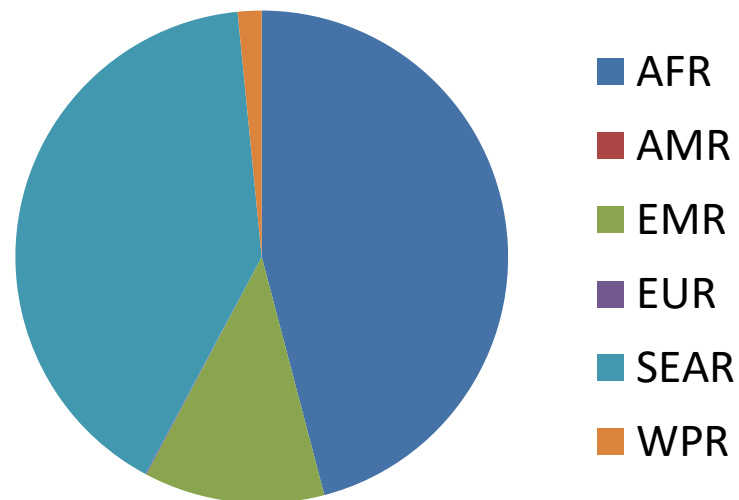
Source: Country reports through the PAHO/WHO/UNICEF Joint Reporting Form (JRF), 2014 and 2015.



# Global Milestone: 95% Reduction in Measles Deaths.



Estimated deaths by  
Region, 2015  
(Total 134,180)



20.3 million deaths prevented since 2000 by measles vaccination

# WHO Recommendation\*

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- ✓ two doses of measles vaccine
- ✓ Minimum interval of one month between doses
- ✓ MCV1 at 9 or 12 months
- ✓ When MCV1  $\geq 80\%$  for 3 years then add MCV2 at:
  - 15-18 months (if country has ongoing measles transmission)
  - school entry (option if near elimination)
- ✓ Very high coverage ( $>90\%$ ) is needed with both doses
  - Mortality reduction:  $\geq 90\%$  national,  $\geq 80\%$  in every district
  - Elimination:  $\geq 95\%$  in every district

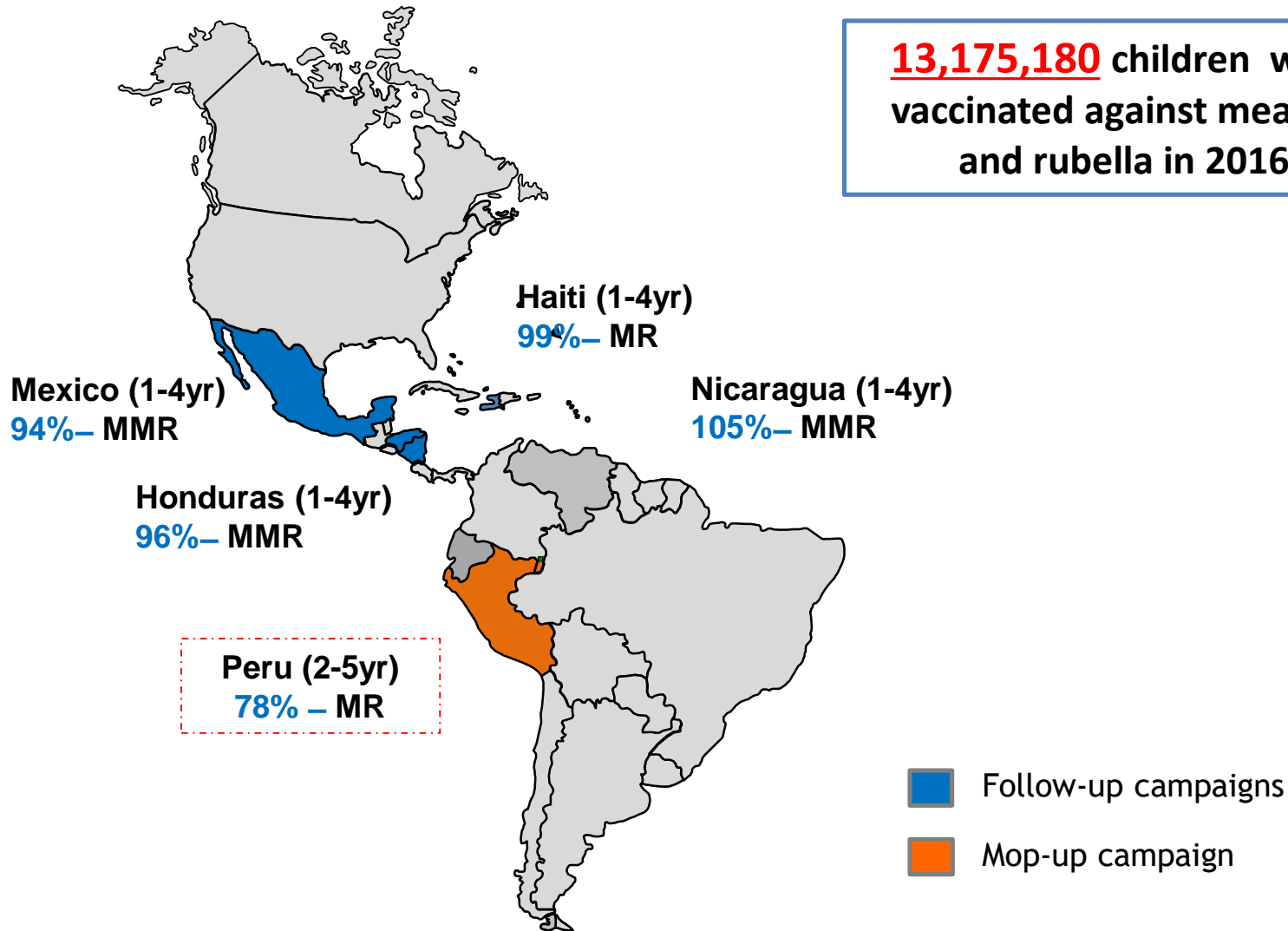
# Status of MMR2 vaccination schedule by country, The Americas, 2017.

Introduced MMR2 at 18 months	Lower the age (18 months) since 2014	No lower the age (4-7yrs)	No MMR2 yet
Dominica	<b>Anguilla*</b>	Argentina	Bolivia
Grenada	<b>Belize*</b>	Bahamas	Haiti
	Antigua & Barbuda	Bermuda	Dom. Republic
	Barbados	Chile	Honduras
	Brazil	Canada	Nicaragua
	Ecuador	Colombia	
	<b>Guyana*</b>	Costa Rica	
	Jamaica	<b>Cuba*</b>	
	Montserrat	Cayman Islands	
	Panama	<b>Mexico*</b>	
	Peru	Paraguay	
	St. Kitts & Nevis	El Salvador	
	<b>Saint Lucia*</b>	Trinidad and Tobago	
	Suriname	St. Vincent & Grenadines	
	Turks and Caicos	United States	
	Virgin Islands	Uruguay	
	Guatemala	Venezuela	

Source: PAHO/WHO/UNICEF Joint Reporting Forms, 2016. \* With => 95% MMR-2 coverage in 2015

# Results of follow-up campaigns against measles and rubella, The Americas, 2016\*

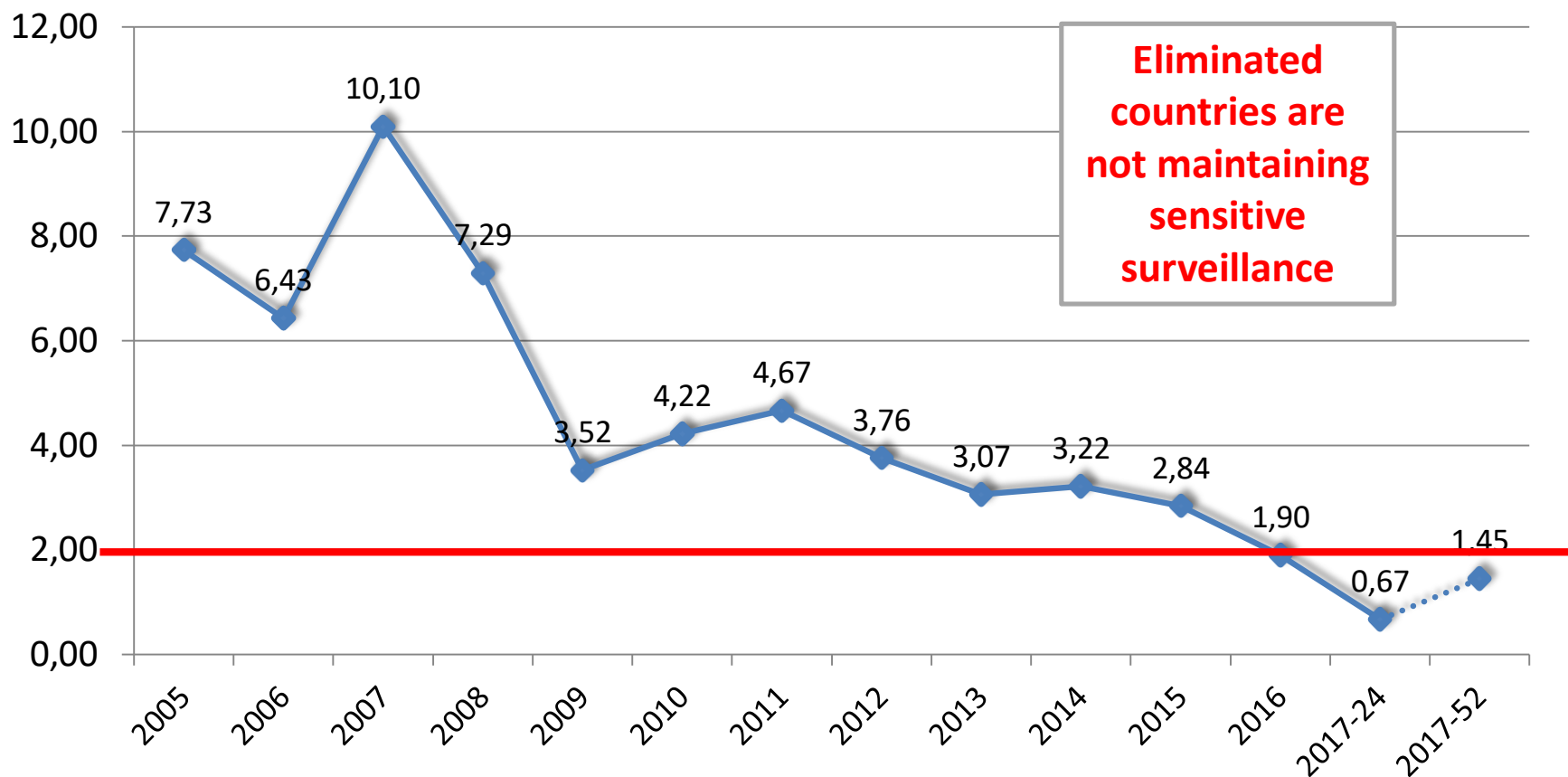
**13,175,180** children were  
vaccinated against measles  
and rubella in 2016



Source: Country reports to PAHO  
\*Data as of May 17, 2017

# Regional rate of measles and rubella suspected cases, Latin America and the Caribbean, 2005-2017\*.

2011: Monitoring the regional rate for 2 suspected cases x 100,000 pop

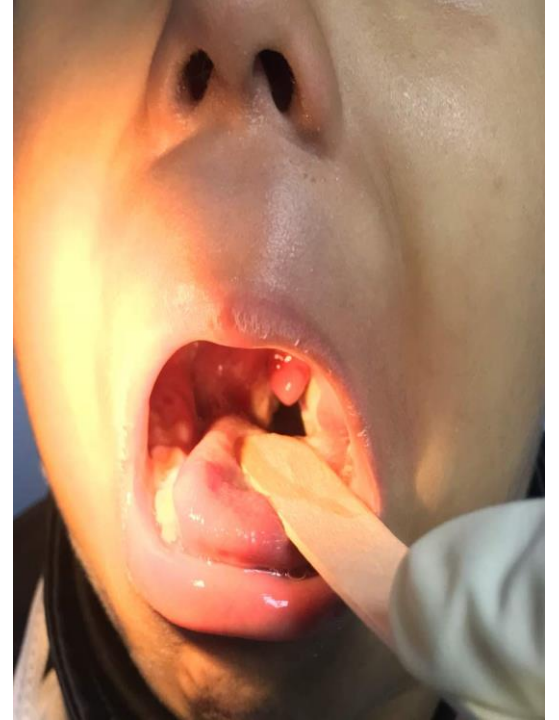
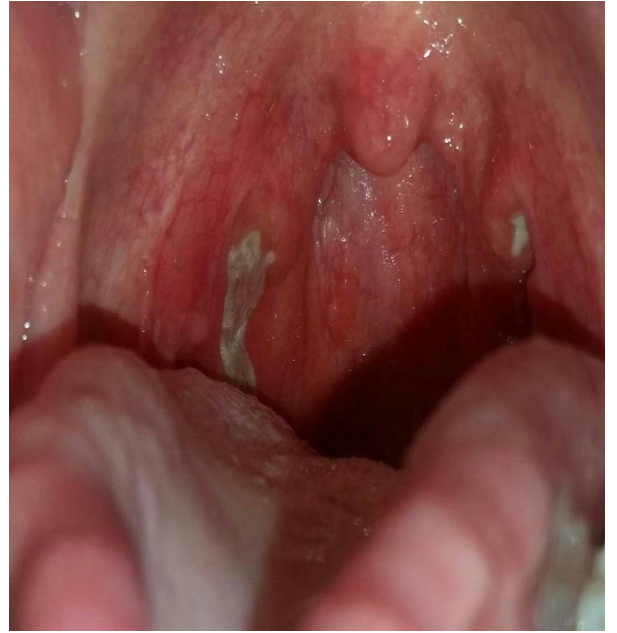


Source: ISIS, MESS and country reports. \*Data as of epidemiological week 25, 2017

# Measles outbreaks: what does it represent for the elimination strategy in the region of the Americas? A call for the action

**Avila-Agüero ML et al**

*Expert Rev. Vaccines* Early online, 1–3 (2015)





# Epidemiological Update Diphtheria

21 September 2018

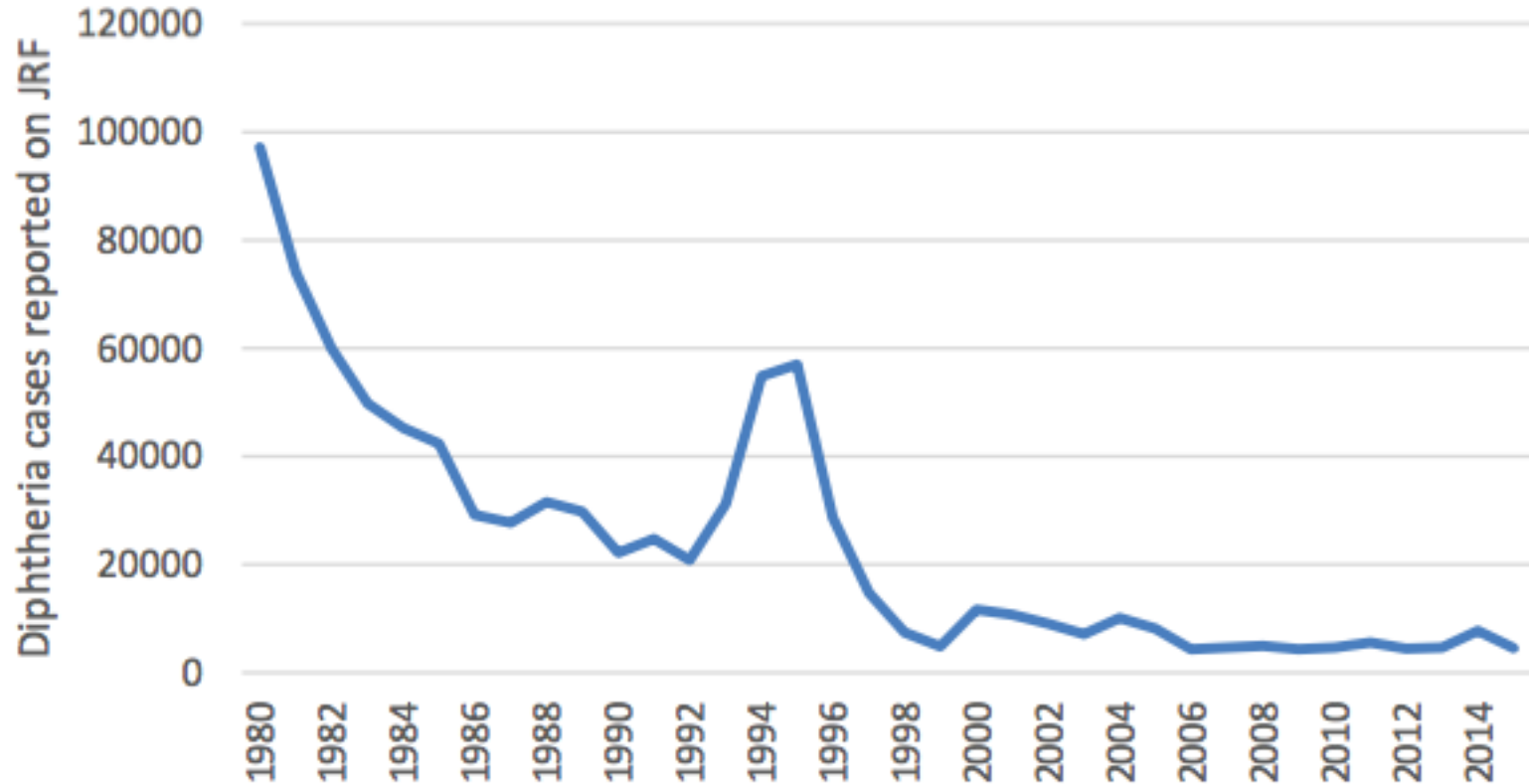
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## Diphtheria in the Americas - Summary of the situation

Between epidemiological week (EW) 1 and EW 37 of 2018, three countries in the Region of the Americas (Colombia, Haiti, and the Bolivarian Republic of Venezuela) have reported confirmed cases of diphtheria. While in Colombia no new cases have been detected (since July 2018), in Haiti and Venezuela the outbreaks are ongoing.

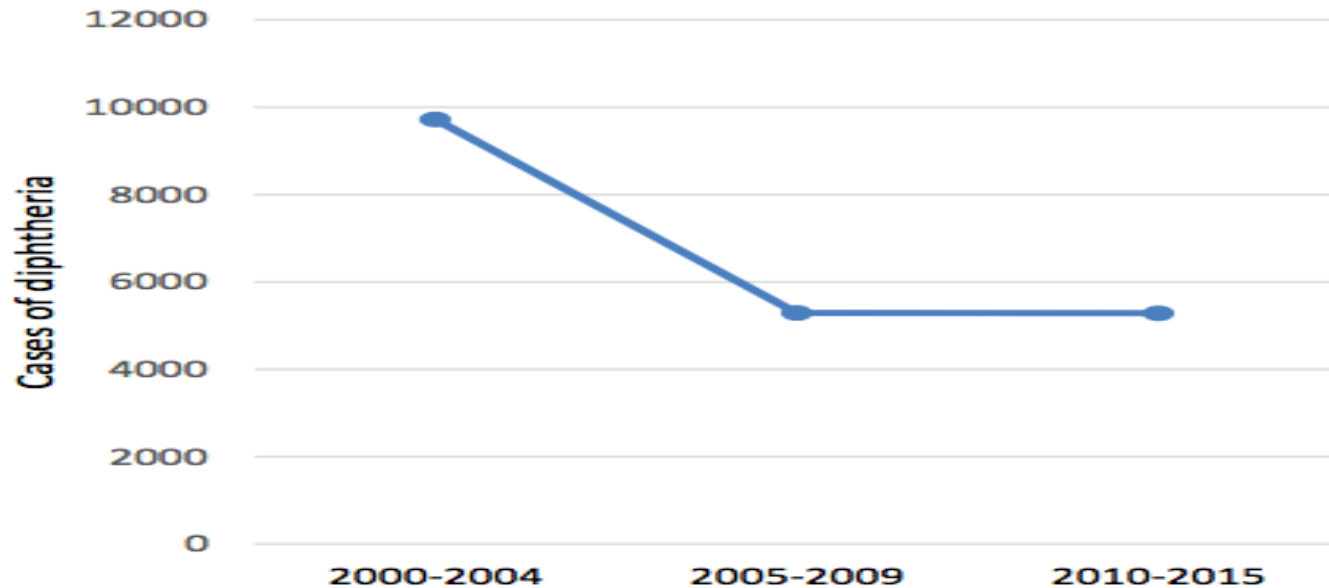


# Diphtheria Worldwide 1980-2015



**Figure 1- Reported cases of diphtheria worldwide- 1980 -2015**

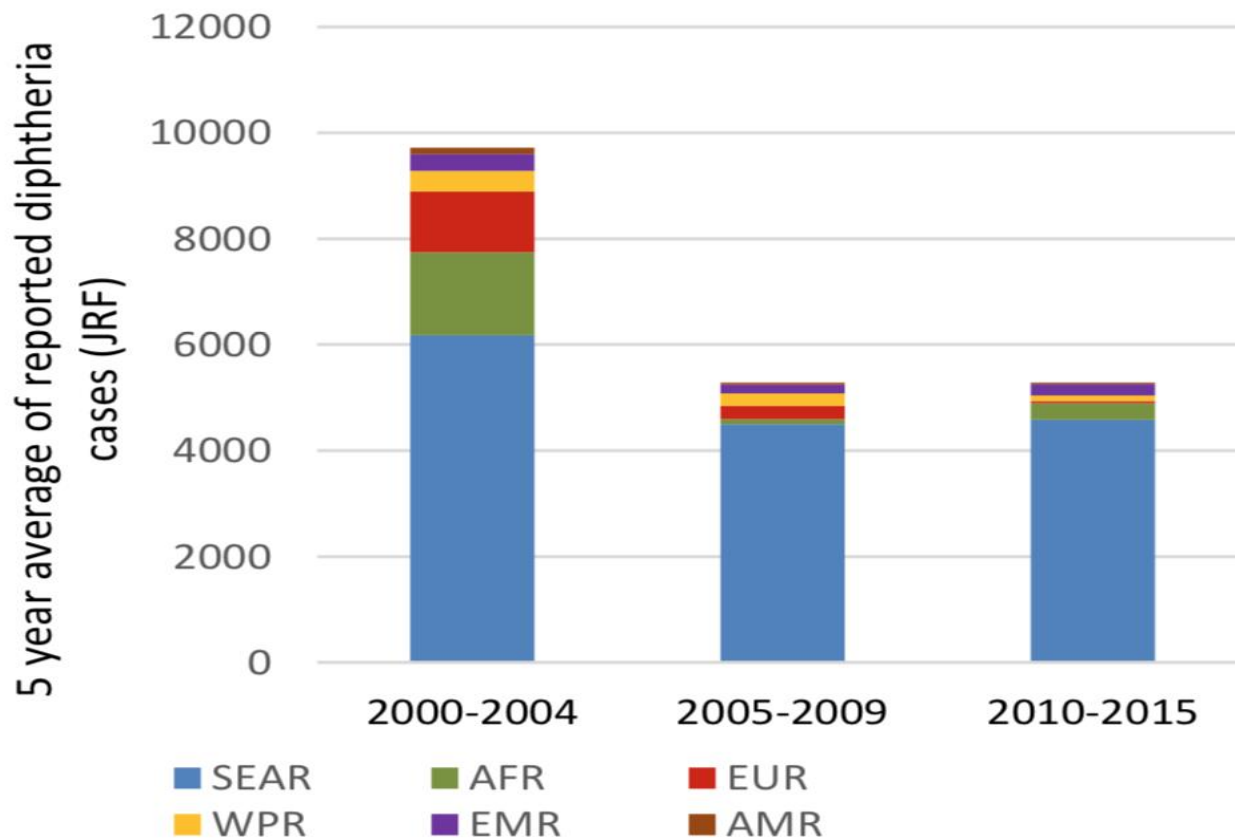
# Reported cases of diphtheria per year worldwide by 5 year average



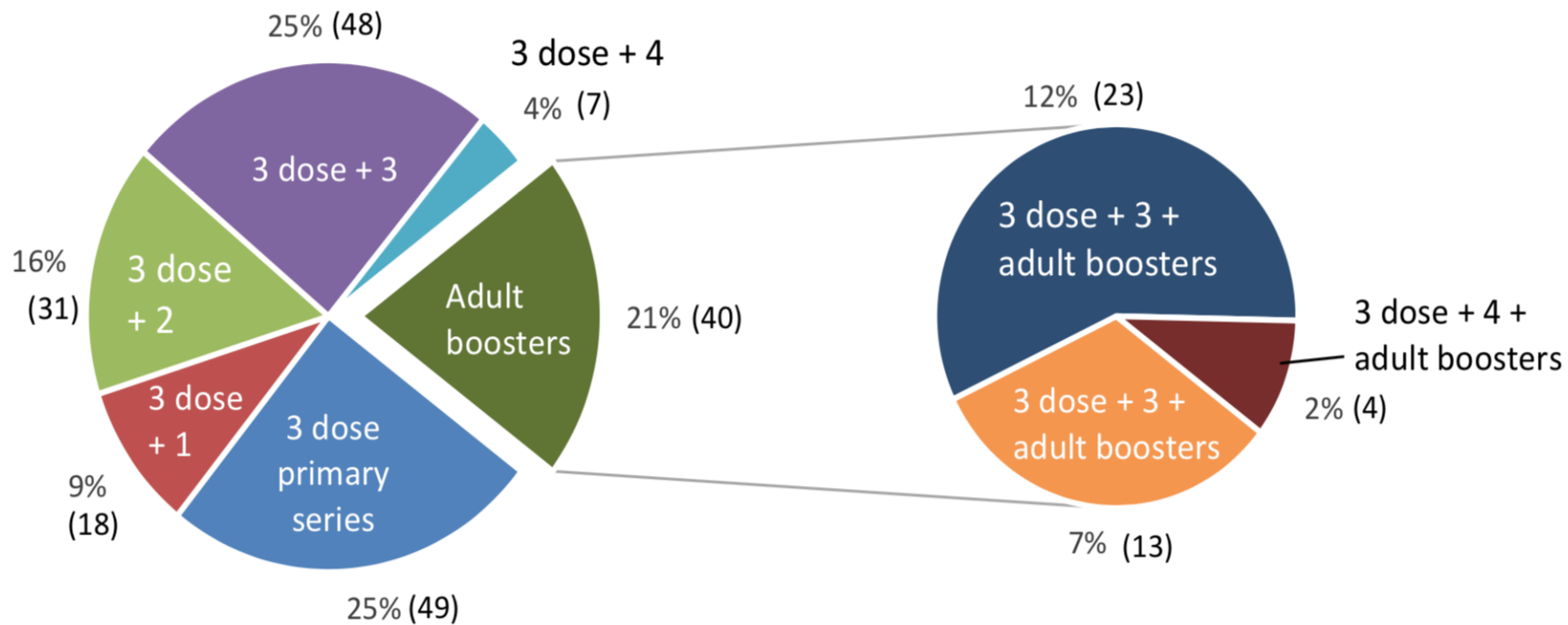
**Figure 2: Reported cases of diphtheria per year worldwide by 5 year average**

Reported diphtheria cases declined from almost **10,000 cases** per year during 2000- 2004 to **5288** per year during 2005-2009.

However, since 2009 annual reported cases have levelled off

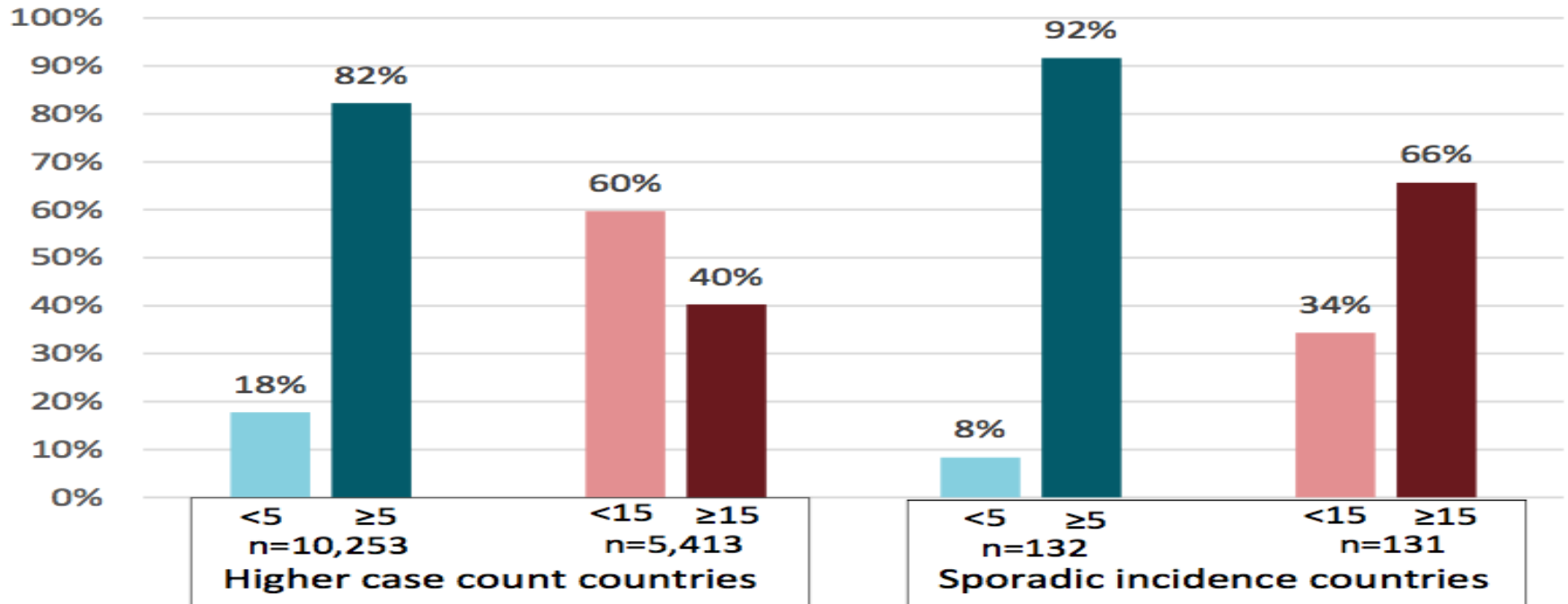


**Figure 3: Cases of diphtheria by region by 5 year averages, 2000-2015**



**Figure 5: Percentage (number) of countries with each diphtheria vaccination schedule - 2016**

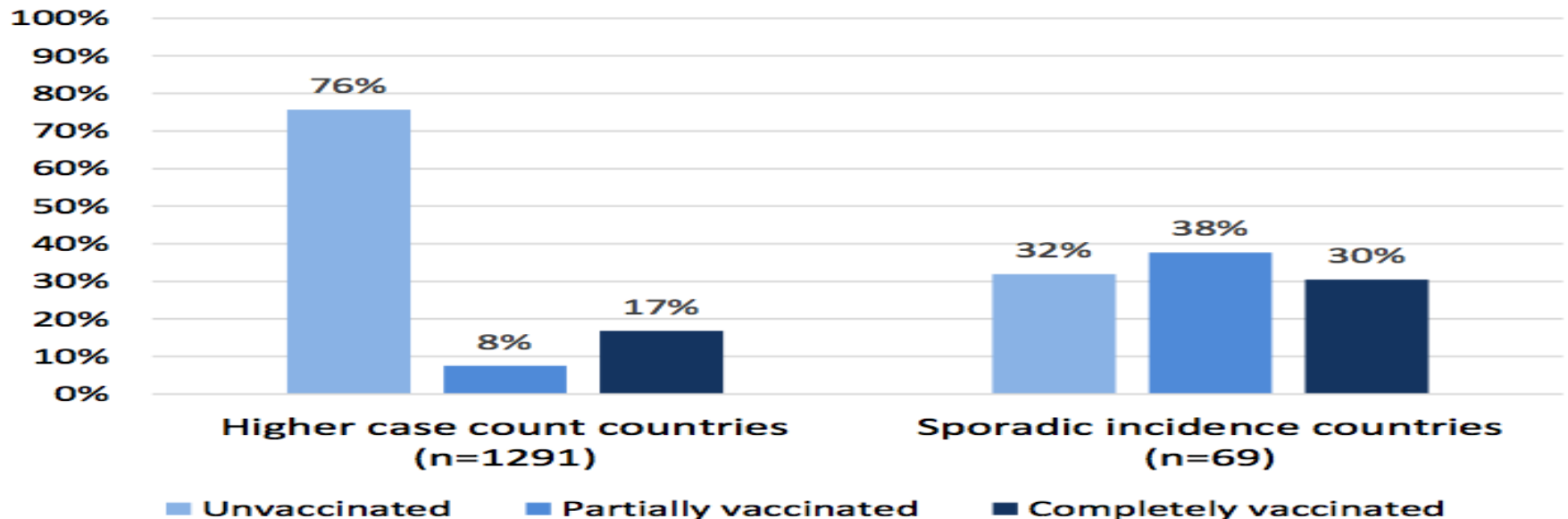
# Sensitivity analysis of age distribution in higher case count *versus* sporadic incidence countries



In high case count countries, approximately 60% of cases are in those under 15, while in sporadic incidence countries the proportions were reversed

66% of cases were in those 15 and older.

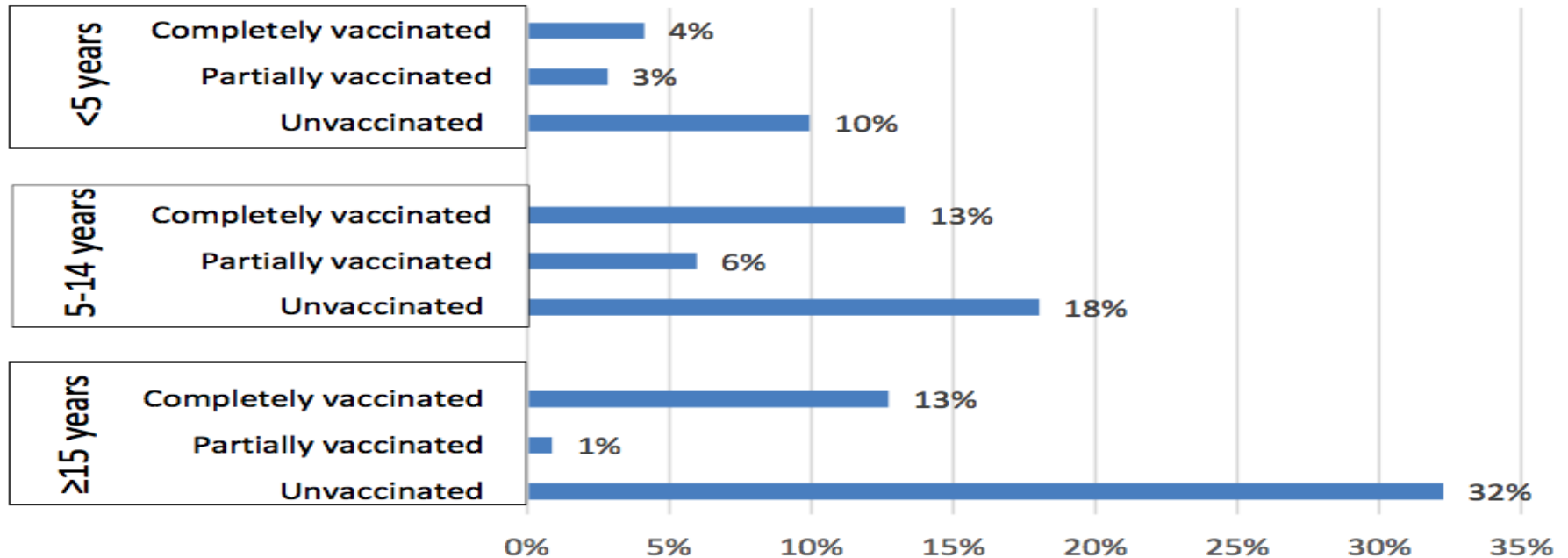
# Vaccination status of cases in high case count countries *versus* sporadic incidence countries



Main challenge in countries with high case counts is achieving adequate coverage with the primary series.

In countries with sporadic incidence, the predominance of older cases taken together with the relatively even distribution of vaccination status indicate that waning immunity might be a bigger issue.

# Distribution of age and vaccination status among all cases with vaccination status for each age group (n=3719)



These data indicate that the lack of vaccination with the primary series tends to be the principal risk factor for infection, yet also support evidence that immunity does wane and booster doses may be relevant.



Contents lists available at ScienceDirect

## Travel Medicine and Infectious Disease

journal homepage: [www.elsevier.com](http://www.elsevier.com)



### Editorial

## The current syndemic in Venezuela: Measles, malaria and more co-infections coupled with a breakdown of social and healthcare infrastructure. Quo vadis?

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# Conclusions

- ❖ **Risk: to import and reestablish the endemic transmission of measles and rubella viruses, undoing the elimination achievements.**
- ❖ **Challenge: to maintain the adequate balance in the fulfillment of three key strategies:**
  1. Guarantee high ( $\Rightarrow$  95%) and homogeneous coverage with two doses of MMR vaccine in every district or municipality.
  2. Guarantee high-quality epidemiological surveillance systems, with the capacity to promptly detect any suspected measles, rubella or CRS case.
  3. Implement a rapid response to imported measles, rubella and CRS cases, following standard mechanisms to prevent the reestablishment of endemic transmission.

# Conclusions

- Progress in decreasing diphtheria incidence worldwide has stalled over the past 10 years.
- A wide variety of diphtheria vaccination schedules are used globally.
- Most diphtheria cases occur in unvaccinated individuals, particularly in countries with higher case counts.
- Countries with higher vaccination coverage had an increased percentage of cases over age 15 years compared to countries with lower vaccination coverage.



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Mike Keefe, Cagle Cartoons