

# Changing Epidemiology of Measles in Africa

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**Background.** In Africa before the introduction of measles vaccination, measles primarily affected young children. To describe measles epidemiology in Africa since the start of accelerated measles control activities in 2001, we analyzed regional measles case-based surveillance data for 2002–2009.

**Methods.** Country-years were grouped by 10-year moving average of routine measles vaccination coverage (aMCV1). Age was log transformed, and pair-wise comparisons of means were made. A  $\chi^2$  test was used to assess association between coverage and age groups. Cumulative percent curves and percentiles of age, dot plots with Loess curve, and Spearman rank correlation coefficient were calculated.

**Results.** Of 180,284 suspected cases, 73,009 (41%) were confirmed as measles. Of these, the mean age was 79 months (median, 36 months; interquartile range, 16–96 months) and significantly younger in country-years with <50% aMCV1 than those with 50%–74% aMCV1 ( $P = .03$ ) and  $\geq 75\%$  ( $P = .02$ ). With increasing coverage, there was a slight decrease in age in the 10th and 25th and moderate increase in age in the 50th, 75th, and 90th percentiles.

**Conclusions.** During 2002–2009, the median age of confirmed measles was 36 months. In countries with  $\geq 50\%$  aMCV1 coverage compared with low-coverage countries, age shifted to older children and young adults; for infants, age decreased slightly with higher coverage.

Measles is one of the most contagious viral diseases known, and it has been preventable since 1963 through vaccination. Serologic and epidemiologic studies indicate that 1-dose measles vaccine efficacy is approximately 85%–90% when given at 9 months of age, and that 2-dose efficacy is >99% when the second dose is given at  $\geq 12$  months of age [1]. Before the discovery of measles vaccine in 1963, epidemic cycles occurred every 2 to 3 years, and virtually everyone experienced measles illness during childhood; >90% of individuals were

infected by the age of 10 years [1, 2]. Natural infection provides lifelong immunity.

In Africa before the introduction of measles vaccination, measles was primarily a disease affecting young children, and >1 million cases were reported annually [3]. In urban areas, measles epidemics occurred every 1–2 years, and the median age of cases was 1.5–2.5 years; in rural areas, outbreaks occurred less frequently, and the median age was 2.5–5.0 years [4]. The first major measles control program in Africa started in 1965. This program included 20 countries as part of the Smallpox Eradication and Measles Control Program [5, 6] and led to elimination of endemic measles virus circulation in the Gambia [7, 8]. During the 1970s and 1980s, measles vaccination through routine vaccination services was established in all African countries through the World Health Organization (WHO) Expanded Program on Immunization [9]. The introduction of measles vaccination throughout the region led to longer interepidemic periods and a shift in the age distribution of remaining cases toward older children; however, measles continued to be primarily a childhood disease [10]. As of 2009, measles vaccine was widely used throughout Africa, and measles incidence was at an historic low [11]. However, outbreaks continue to occur, and case fatality rates among young children can

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be as high as 5%–10% during outbreaks [1]. With an estimated 28,000 measles-related deaths still occurring each year [11], measles remains a major public health problem in Africa.

Achieving and sustaining high measles vaccination coverage can lead to regional measles elimination. However, to interrupt endemic transmission of measles virus, mathematical models indicate that ≥93%–95% population immunity is needed [1, 12]. In the region of the Americas, measles was declared eliminated in 2002 after the successful implementation of a strategy that included achieving and sustaining a very high coverage ( $\geq 95\%$ ) of children aged 1 year with measles vaccine through routine services, and periodically conducting high-quality mass measles vaccination campaigns [13, 14]. Application of similar strategies in 7 southern African countries led to similar results [15].

Starting in 1996, 7 southern African countries (Botswana, Lesotho, Malawi, Namibia, South Africa, Swaziland, and Zimbabwe) implemented a measles control strategy, adapted from the strategies that led to measles elimination in the Americas, and began conducting nationwide measles vaccination campaigns [16]. These efforts led to historic low measles incidence in these countries and virtual elimination of measles-related deaths, and prompted regional accelerated measles control efforts throughout Africa [15].

In 2003, the World Health Assembly endorsed a global goal to reduce measles mortality by 50% by 2005, compared with the mortality in 1999 [17, 18]. Through measles control strategies that included increasing routine immunization coverage and mass vaccination campaigns, the goal was achieved [18], and a new goal was established to achieve 90% reduction by 2010, compared with the mortality in 2000 [19–21].

The WHO-recommended strategy for measles control in Africa, established in 2001, includes the following components: (1) increasing routine vaccination coverage with the first dose of measles-containing vaccine (MCV1) for all children, (2) providing a second dose of MCV to be given through supplemental immunization activities (SIAs), (3) improving measles case management, and (4) establishing case-based surveillance with laboratory confirmation for all suspected measles cases [22]. During 2001–2008, routine measles vaccination coverage in Africa increased from 54% to 73% [23, 24], and approximately 400 million children were vaccinated during SIAs, resulting in a decrease in estimated measles mortality from 395,000 deaths in 2000 to 28,000 in 2008, a 92% reduction [11, 25, 26]. In 1999, as part of the measles mortality reduction strategy, case-based surveillance with laboratory testing for all suspected measles cases was introduced. By 2009, all African countries except Algeria, Comoros, Guinea Bissau, Mauritius, Sao Tome & Principe, and Seychelles had established measles case-based surveillance in accordance with the WHO African Regional Office measles surveillance guidelines [25]. In 2009, WHO African member states endorsed a goal of >98% reduction in measles mortality by 2012, compared with mortality in 2000,

and an additional goal of regional measles elimination by 2020 was adopted [27].

The implementation of the regional measles control strategy and progress towards measles mortality reduction during 2000–2008 have been well documented [11, 25, 28]; however, few reports [26, 29, 30] exist describing the changing epidemiology of measles in Africa following these efforts. In recent years, several measles outbreaks in Africa have been characterized by cases occurring in older children and adults [29, 31, 32]. To describe current measles epidemiology in Africa and to explore the relationship between increasing MCV coverage and the age distribution of cases, we conducted an analysis of the regional measles case-based surveillance data.

## METHODS

Regional measles case-based surveillance data collected by 40 African countries during 2002–2009 were analyzed. Each country was included in the analysis starting in the year following completion of the nationwide catch-up SIA and all subsequent years. The data were collected following the WHO guidelines [33] and using a standard case definition for a suspected measles case: any person with a generalized maculopapular rash and fever and  $\geq 1$  of the following: cough, coryza (runny nose), or conjunctivitis [33]. National surveillance officers used individual case investigation forms to collect data on suspected cases (age, sex, address, number of measles vaccine doses received, and date of last measles vaccination). Serum samples were collected within 30 days of rash onset for laboratory testing; confirmation was made by detection of measles immunoglobulin M (IgM) antibody at an accredited national measles laboratory using a standard commercial indirect enzyme-linked immunosorbent assay kit (Enzygnost for IgM; Dade Behring) [34]. Laboratory confirmation of cases was discontinued after an outbreak had been confirmed as measles, per WHO African Regional Office measles surveillance guidelines [33]. Cases were classified by the national surveillance unit as laboratory-confirmed, clinically compatible, or epidemiologically linked or were discarded. *Discarded cases* were those with a negative laboratory test result for detection of measles-specific IgM antibody. *Epidemiologically linked cases* were defined as cases without a sample for laboratory testing that met the suspected measles case definition and either had contact with a laboratory-confirmed case that had rash onset within the preceding 30 days or lived in the same or adjacent district of a laboratory-confirmed case with plausibility of measles virus transmission [33]. *Clinically compatible cases* included those who met the clinical case definition, for whom neither a sample for laboratory testing nor an epidemiologic link to a laboratory-confirmed case were available. *Confirmed cases* were defined as those classified as laboratory-confirmed, clinically compatible, or epidemiologically linked. Case investigation form data, along

with laboratory results, were entered into national measles case-based surveillance systems and shared with WHO African Regional Office. Measles incidence was calculated using confirmed measles cases and country-year population estimates from the United Nations Population Division [35].

The countries included in the analysis were divided into 4 subregions, with the group of 7 southern African countries that started campaign implementation in the region (Botswana, Lesotho, Malawi, Namibia, South Africa, Swaziland, and Zimbabwe) being the *South* group and the 3 WHO African Regional Office subregions being *Central* (Angola, Burundi, Cameroon, Central African Republic, Chad, Congo, Democratic Republic of the Congo, Equatorial Guinea, Gabon, and Rwanda), *East & South* (Eritrea, Ethiopia, Kenya, Madagascar, Mozambique, Tanzania, Uganda, and Zambia) (except countries in *South*), and *West* (Benin, Burkina Faso, Côte d'Ivoire, Gambia, Ghana, Guinea, Liberia, Mali, Mauritania, Nigeria, Niger, Senegal, Sierra Leone, and Togo). For each country and year (country-year), a moving average of MCV1 coverage during the previous 10 years (aMCV1) was calculated using the WHO and United Nations Children's Fund (UNICEF) estimates of coverage among children aged 1 year with the first routinely scheduled dose of measles-containing vaccine (MCV1) [24]. In general, MCV1 coverage in African countries increased following implementation of accelerated measles control during the past decade, thus an aMCV1 was used to represent coverage. Country-years were divided according to aMCV1 coverage into 3 vaccination coverage groups: <50%, 50%–74%, or ≥75%. Age was log transformed, and pair-wise comparisons of the means of each aMCV1 coverage group were made. In addition, age was categorized into 5 groups (<9 months, 9 months–4 years, 5–9 years, 10–14 years, and ≥15 years), and a  $\chi^2$  test was performed to assess whether there were a significant association

between vaccination coverage groups and age groups. Tests accounted for the potential cluster effect of country with standard errors estimated by means of the Taylor-series method.

Cumulative percent curves were used to graphically describe the age distribution of confirmed measles cases for each country-year. In addition, for country-years with ≥30 cases, the 10th, 25th (Q1), 50th (median), 75th (Q3), and 90th percentiles of the age distribution of confirmed measles cases were calculated for each country-year. Dot plots of aMCV1 against each estimate percentile, including a Loess curve, were used to explore the relationship between estimated aMCV1 coverage and the age distribution of confirmed measles cases. Loess is a method using local polynomial regression fitting [36]. The Spearman rank correlation coefficient, a nonparametric measure of statistical dependence, was calculated for aMCV1 coverage and each set of percentiles. Given that we cannot incorporate into the estimates of the curve or the correlation the inherent variability of the estimated percentiles, we do not report  $P$  values but rather emphasize that this is a descriptive exploration. Data were analyzed using SAS, version 9.2 (SAS Institute) and R, version 2.11.0 (Free Software Foundation, GNU project).

## RESULTS

The number of countries included in the analysis of the case-based surveillance data was 10 from 2002, 15 from 2003, 26 from 2004, 31 from 2005, 37 from 2006, 39 from 2007, and 40 from both 2008 and 2009. During 2002–2009, there were 180,284 suspected measles cases reported. Of these, 97,204 (54%) were discarded because of a negative or indeterminate measles-specific IgM test result; 10,071 (14%) had unknown classification; and 73,009 (41%) were confirmed as measles. Among the 73,009 confirmed cases, 31,915 (44%) were classified as

**Table 1. Confirmed Measles Cases by Sex, Setting, Age Group, and Vaccination Status, 2002–2009, World Health Organization (WHO) African Region**

No. of cases <sup>a</sup>	Male sex	Setting <sup>b</sup>				Age group						Vaccination status													
		Urban		Rural		< 9 mo		9 mo–4 y		5–9 y		10–14 y		≥ 15 y		1 dose		≥ 2 doses		None		Missing			
Year	n	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%		
2002	1543	852	56	761	69	341	31	199	13	516	35	234	16	82	5	464	31	196	13	208	13	867	56	272	18
2003	4915	2517	52	796	18	3585	82	479	10	2157	44	995	21	462	10	767	16	665	14	443	9	2,413	49	1,394	28
2004	4458	2242	52	799	22	2774	78	458	11	2011	46	990	23	466	11	405	9	474	11	239	5	1,750	39	1,995	45
2005	4289	2134	51	1153	34	2273	66	496	12	2028	48	783	19	358	9	547	13	624	15	130	3	1,910	45	1,625	38
2006	11,900	5899	52	3249	35	6109	65	1412	12	5477	47	1879	16	809	7	2185	19	2,344	20	413	3	3,752	32	5,391	45
2007	8599	4455	52	1593	21	5859	79	762	9	4266	50	1725	20	749	9	1010	12	1,649	19	425	5	3,621	42	2,904	38
2008	17,989	9175	52	2106	27	5655	73	1103	6	11,523	64	3099	17	929	5	1271	7	3,973	22	696	4	10,926	61	2,394	13
2009	19,316	10,037	52	6784	45	8312	55	2093	11	8407	44	3359	18	1536	8	3592	19	2,636	14	384	2	10,480	54	5,816	30
Total	73,009	37,311	52	17,241	33	34,908	67	7002	10	36,385	51	13,064	18	5391	8	10,242	14	12,561	17	2,938	4	35,719	49	21,791	30

**NOTE.** <sup>a</sup> Confirmed by laboratory testing, epidemiologic link, or clinically compatible as reported by countries using measles case-based surveillance to the WHO African Regional Office.

**b** Classification reported as either urban or rural; 20,860 cases had a missing value.

**Table 2. Confirmed Cases by Sex, Setting, Age Group, Vaccination Status for Country-Years With the Highest Measles Incidence, 2002–2009, World Health Organization (WHO) African Region**

Country	Year	Annual incidence per 100,000 <sup>a</sup>	No. of cases <sup>b</sup>	Setting <sup>c</sup>				Age group										Vaccination status											
				Male sex		Urban		Rural		<9 mo		9 mo–4 y		5–9 y		10–14 y		≥15 y		1 dose		≥2 doses		None		Missing		aMCV1	
				n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%		
Namibia	2009	70.0	1,520	720	52	344	38	550	62	514	34	439	29	54	4	35	2	457	31	60	4	16	1	569	37	875	58	68	
Equatorial Guinea	2008	65.7	433	236	55	306	71	124	29	68	16	280	65	54	13	9	2	22	5	182	42	0	0	248	57	3	1	54	
Namibia	2002	56.0	1,063	638	60	754	71	308	29	165	16	344	34	49	5	32	3	426	42	127	12	17	2	799	75	120	11	66	
Mali	2009	22.5	2,927	1,525	52	1,019	46	1,210	54	180	6	1,281	44	595	20	258	9	612	21	82	3	1	<1	2,843	97	1	<1	61	
Burkina Faso	2003	17.6	2,257	1,171	52	117	5	2,135	95	213	10	1,026	46	394	18	156	7	452	20	71	3	10	<1	1,194	88	182	8	48	
Botswana	2009	14.0	272	127	47	129	48	140	52	26	10	30	11	30	11	75	28	109	40	35	13	14	5	3	1	220	81	92	
Angola	2009	12.9	2390	1,255	54	432	19	1,869	81	281	12	968	41	211	9	134	6	755	32	692	29	5	<1	1,411	59	282	12	62	
Benin	2009	10.2	914	468	51	99	11	814	89	97	11	470	51	217	24	57	6	73	8	125	14	66	7	519	57	204	22	66	
Niger	2008	8.8	1,289	676	53	296	24	952	76	65	5	509	40	250	20	130	10	306	24	102	8	9	<1	530	41	648	50	44	
Kenya	2006	8.2	3,008	1,520	52	480	49	501	52	548	19	1,064	36	428	15	143	5	776	26	539	18	81	3	895	30	1,493	50	75	
Benin	2008	8.0	689	346	50	35	5	653	95	44	6	335	49	189	27	72	10	49	7	50	7	2	<1	479	70	158	23	66	
Senegal	2009	7.8	982	522	53	858	88	122	12	71	7	587	60	219	22	39	4	63	6	129	13	0	0	852	87	1	<1	64	
Nigeria	2008	6.6	9,948	5,021	52	699	29	1,720	71	424	4	7,648	77	1,386	14	274	3	202	2	2,202	22	512	12	6,809	68	425	4	47	
Rwanda	2006	6.3	584	324	56	106	18	478	82	56	10	341	60	112	20	19	3	44	8	207	36	25	4	317	54	35	6	77	
Zambia	2007	6.1	752	367	49	13	12	97	88	87	12	396	53	113	15	36	5	118	16	307	41	0	0	140	19	305	41	85	
Angola	2006	5.3	910	476	53	549	61	359	40	153	17	574	63	71	8	33	4	77	9	208	23	1	<1	688	76	13	1	61	
Niger	2009	5.2	788	390	50	301	38	486	62	62	8	345	44	156	20	72	9	150	19	26	3	2	<1	461	59	299	38	48	
Zimbabwe	2009	4.5	566	234	46	76	17	381	83	26	5	211	37	199	35	110	19	20	4	11	2	10	2	544	96	1	<1	70	
Cameroon	2009	4.5	876	453	52	704	85	126	15	84	10	526	60	186	21	46	5	32	4	243	28	8	1	600	68	25	3	62	
Uganda	2006	4.5	1,323	690	52	172	13	1,151	87	172	13	742	56	163	12	66	5	180	14	239	18	66	5	16	1	1,002	76	60	
Ghana	2003	4.3	906	489	54	451	51	435	49	51	6	412	46	218	24	118	13	105	12	265	29	279	31	0	0	362	40	74	
Benin	2007	4.1	347	181	52	13	4	334	96	11	3	231	67	81	23	17	5	7	2	8	2	3	1	232	67	104	30	67	
Ethiopia	2008	3.9	3,162	1,688	53	176	25	538	75	261	8	1,541	49	725	23	255	8	380	12	1,064	34	105	3	1,528	48	465	15	56	
Ghana	2004	3.7	782	393	50	414	55	345	45	50	6	355	45	213	27	90	12	73	9	221	28	115	15	0	0	446	57	76	
Burkina Faso	2009	3.6	564	342	61	117	21	446	79	48	9	159	28	67	12	60	11	230	41	61	11	9	2	453	80	41	7	64	
Chad	2009	3.6	400	196	49	307	78	87	22	17	4	232	58	72	18	31	8	48	12	3	1	1	<1	5	1	391	98	25	
Cameroon	2005	3.4	609	290	48	175	29	432	71	61	10	414	69	72	12	22	4	32	5	57	9	6	1	536	81	10	2	50	
Tanzania	2007	3.2	1,338	691	52	118	9	1,216	91	161	12	393	30	359	27	185	14	220	17	108	8	1	<1	223	17	1,006	75	85	
Ethiopia	2009	3.2	2,644	1,371	52	384	33	775	67	156	6	1,234	47	727	28	264	10	263	10	522	20	99	4	696	26	1,327	50	58	
Benin	2006	3.2	259	129	50	15	6	244	94	26	10	145	56	43	17	21	8	24	9	22	8	5	2	190	73	42	16	67	
South Africa	2009	3.2	1,596	841	54	1,432	91	149	9	307	20	334	21	144	9	201	13	574	37	20	1	18	1	107	7	1,451	91	65	
Mali	2004	3.1	358	166	47	16	4	340	96	6	2	114	32	90	25	70	20	78	22	10	3	0	0	98	27	250	70	54	
Niger	2005	2.9	377	200	53	129	34	247	66	31	8	150	40	63	17	41	11	90	24	32	8	4	1	269	71	72	19	38	
Cameroon	2008	2.6	496	251	51	242	49	254	51	42	9	329	67	80	16	18	4	21	4	40	8	1	<1	443	89	12	2	58	
Tanzania	2004	2.5	964	542	57	30	3	934	97	57	6	521	54	265	28	80	8	35	4	17	2	7	1	897	93	43	4	81	
Togo	2009	2.5	167	104	62	42	25	125	75	16	10	83	50	37	22	17	10	14	8	43	26	0	0	61	37	63	38	66	

**Table 2.** (Continued)

Ghana	2006	2.5	564	282	50	253	46	299	54	32	6	300	53	101	18	49	9	80	14	218	39	21	4	4	1	321	57	78
Swaziland	2006	2.5	28	10	36	0	0	22	100	0	0	2	8	14	54	10	38	0	0	0	0	18	64	0	0	10	36	78
Cameroon	2004	2.4	416	224	54	100	24	316	76	48	12	297	72	32	8	16	4	21	5	19	5	6	1	382	92	9	2	47
Ghana	2007	2.3	532	295	56	249	47	278	53	21	4	244	46	167	31	57	11	42	8	194	36	77	14	5	1	256	48	80
Benin	2004	2.3	177	94	53	20	11	157	89	20	11	74	42	28	16	21	12	34	19	11	6	3	2	95	54	68	38	69
Burkina Faso	2008	2.3	349	193	55	121	35	228	65	39	11	102	29	62	18	39	11	107	31	42	12	6	2	273	78	28	8	61
Benin	2005	2.2	169	89	53	14	8	155	92	9	5	111	66	20	12	11	7	18	11	7	4	2	1	139	82	21	12	67
Ethiopia	2006	2.1	1,641	793	50	630	39	980	61	101	6	691	42	295	18	165	10	389	24	331	20	23	1	316	19	971	59	54
Ghana	2005	2.0	442	226	52	199	46	230	54	47	11	205	47	104	24	28	6	55	13	152	34	28	6	2	<1	260	59	71
Swaziland	2003	2.0	22	12	55	4	19	17	81	0	0	2	10	17	81	2	10	0	0	1	5	1	5	1	5	19	86	82

**NOTE:** aMCV1 is the moving average of the prior 10 years of WHO and United Nations Children's Fund estimates of coverage for the first dose of measles-containing vaccine.

<sup>a</sup> Annual measles incidence was calculated using confirmed measles cases from national measles case-based surveillance and population estimates from the United Nations Population Division [35]; table includes country-years with  $\geq 2$  cases per 100,000 population.

<sup>b</sup> Confirmed by laboratory testing, epidemiologic link, or clinically compatible as reported by countries using measles case-based surveillance to the WHO African Regional Office.

<sup>c</sup> Setting classification reported as either urban or rural; percentages are of those without a missing value.

laboratory confirmed; 32,562 (45%) as epidemiologically linked; and 8532 (12%) as clinically compatible. Among 73,009 confirmed cases, 11,132 (15%) were from the *Central* subregion, 21,573 (30%) from the *East & South*, 31,995 (44%) from the *West*, and 8309 (11%) from the *South*. Among confirmed cases, 71% had information on setting (urban vs rural); of these, 33% were from urban areas and 67% from rural areas (Table 1).

During 2002–2009, males accounted for 52% of confirmed measles cases (Table 1). Analysis of the age distribution of confirmed measles cases found that 10% were  $<9$  months, 51% were 9 months–4 years, 18% were 5–9 years, 8% were 10–14 years, and 14% were  $\geq 15$  years (Table 1). Of the confirmed cases, 72,084 (99%) had information on age; the mean age was 79 months (median, 36 months; interquartile range [IQR], 16–96 months). Information on age and setting (urban or rural) was available for 52,149 (71%) of the confirmed cases; the mean age in urban settings was 80 months (median, 36 months; IQR, 12–96 months) and in rural settings was 89 months (median, 48 months; IQR, 20–120 months). Overall, 30% of cases were missing information for vaccination status, 49% were unvaccinated, 17% received 1 dose, and 4% received  $\geq 2$  doses of MCV (Table 1). During 2002–2009, there were 46 country-years with annual measles incidence  $\geq 2$  cases per 100,000 population (Table 2).

Overall, aMCV1 for each country-year ranged from 25% to 92% (mean, 60%; median, 60%; IQR, 48%–69%). Age categorized into 5 groups was significantly associated with the 3 coverage groups ( $P < .001$ ; Table 3). The percentages of cases in the group  $<9$  months of age and in the adult group ( $\geq 15$  years of age) were higher in country-years with  $\geq 50\%$  aMCV1 coverage compared with the corresponding percentages for country-years with  $<50\%$  coverage. The percentage of cases in the 9–59 month group decreased as coverage increased. Figure 1 shows the distribution of age in months for each coverage group by means of box-and-whisker plots. The upper whisker extends from the box to 2 times the IQR. The graph is truncated at approximately 360 months. The log transformed mean age of cases from country-years with  $<50\%$  aMCV1 was significantly younger than that of cases from country-years with 50%–74% aMCV1 ( $P = .03$ ) and with  $\geq 75\%$  aMCV1 ( $P = .02$ ); there was no detectable difference in age between the 50%–74% aMCV1 group and the  $\geq 75\%$  aMCV1 group ( $P = .8$ ).

Cumulative age distribution curves were made for each aMCV1 coverage group (Figure 2). Median age of cases in the low (<50% aMCV1), moderate (50%–74% aMCV1), and high ( $\geq 75\%$  aMCV1) coverage groups were 36, 48, and 49 months, respectively (Figures 1 and 2). The 75th percentiles were 60, 120, and 108, respectively. To show the variation in the age distribution by country-year, cumulative age distributions for each country-year with  $\geq 30$  cases are also shown.

To further explore the relationship between increasing coverage and a changing age distribution, dot plots of each

**Table 3. Confirmed Measles Cases ( $N = 72,084$ ) by 10-Year Moving Average of Coverage Estimates for the First Dose of Measles-Containing Vaccine (aMCV1) and Age Group, 2002–2009, World Health Organization (WHO) African Region**

aMCV1 Coverage	Age group										Median age <sup>a</sup> months	Total no. of cases <sup>b</sup> <i>n</i>		
	<9 mo		9 mo–4 y		5–9 y		10–14 y		≥15 y					
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%				
<50%	1430	6.2	15,102	65.8	3574	15.6	1089	4.7	1771	7.7	36.0	22,966		
50%–74%	4489	11.8	16,532	43.4	6819	17.9	3213	8.4	7043	18.5	48.0	38,096		
≥75%	1083	9.8	4751	43.1	2671	24.2	1089	9.9	1428	13.0	49.0	11,022		
Total	7002	9.7	36,385	50.5	13,064	18.1	5391	7.5	10,242	14.2	36.0	72,084		

**NOTE.** aMCV1 is the moving average of the prior 10 years of WHO and United Nations Children's Fund estimates of coverage for the first dose of measles-containing vaccine.

<sup>a</sup>  $P < .001$ , adjusted clustering by country.

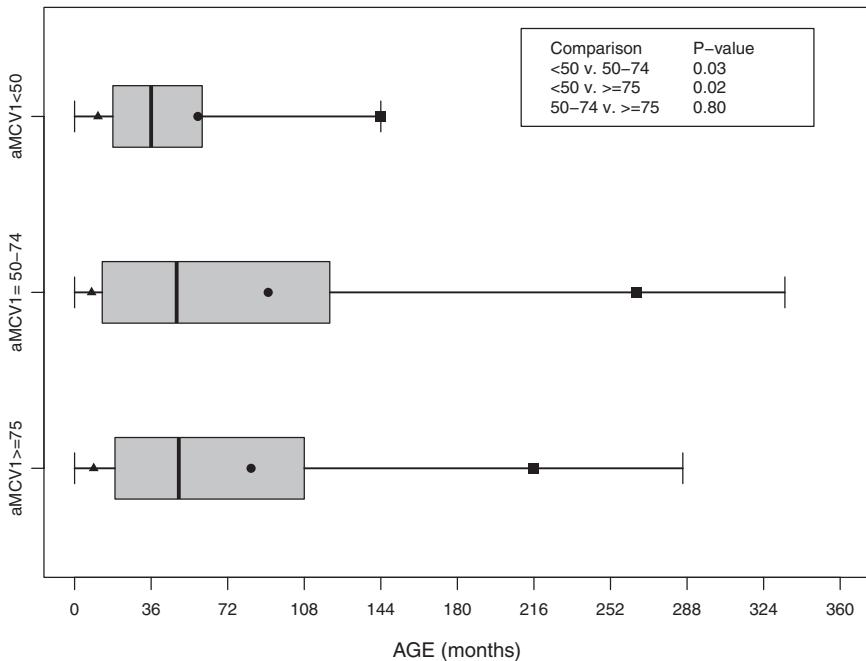
<sup>b</sup> Confirmed by laboratory testing, epidemiologic link, or clinically compatible as reported by countries using measles case-based surveillance to the World Health Organization African Regional Office.

country-year's 10th, 25th, 50th, 75th, and 90th percentiles of age against the 10-year moving average for that country-year were created (Figure 3); this analysis included country-years with  $\geq 30$  cases. A Loess curve and the estimated Spearman rank correlation describe the observed correlation between the given percentile and aMCV1 coverage. The Loess curves and estimated Spearman rank correlations show a slight decrease in the 10th and 25th percentiles with increasing vaccination coverage, indicating a possible shift to younger children. In contrast, the 50th, 75th, and 90th percentiles show a moderate increase with

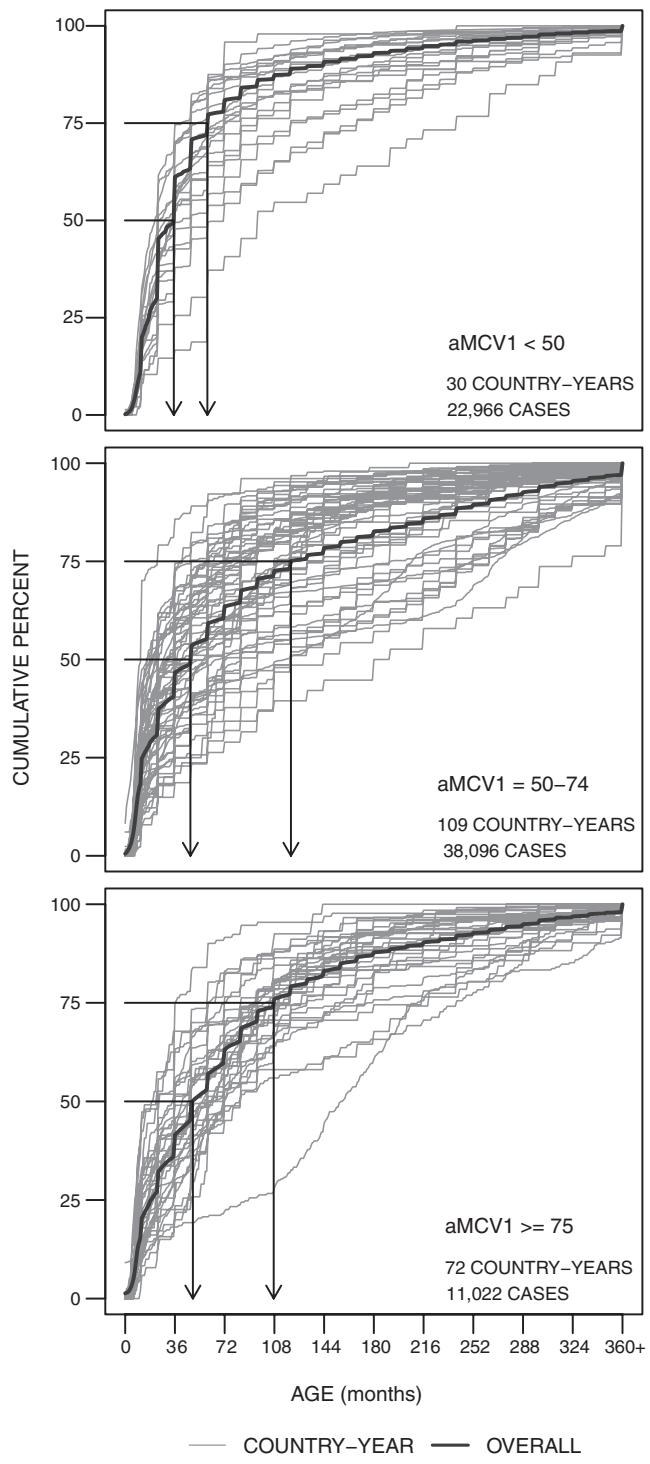
increasing vaccination coverage. Given the limitations of the data and the methods, it is uncertain whether these correlations are statistically significant.

## DISCUSSION

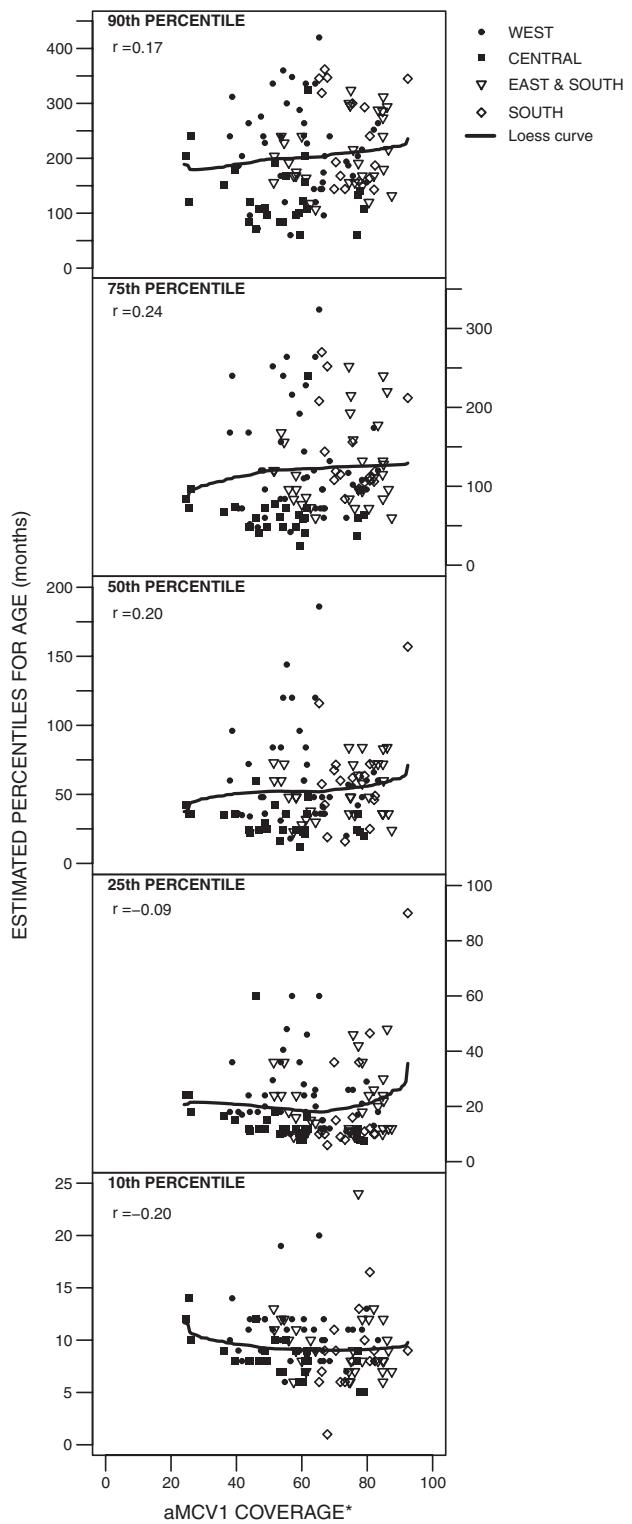
During 2002–2009, the median age of confirmed measles cases in Africa was approximately 36 months, similar to that of the pre-vaccine era; however, 40% of cases were  $>5$  years of age and 14% were adults  $\geq 15$  years of age. In countries with  $>50\%$



**Figure 1.** Box plots of the age distribution of confirmed measles cases ( $N = 72,084$ ) by aMCV1 coverage group for 211 country-years, 2002–2009, World Health Organization African Region. The box represents the interquartile range (25th and 75th percentiles); black bar, median; black triangle, 10th percentile; black dot, mean; black square, 90th percentile. The confirmed measles cases are as reported by countries using measles case-based surveillance to the World Health Organization (WHO) African Regional Office. aMCV1, moving average of the prior 10 years of WHO and United Nations Children's Fund estimates of coverage for the first dose of measles-containing vaccine.



**Figure 2.** Cumulative distribution frequencies of confirmed measles cases ( $N = 72,084$ ) by age in years for 211 country-years by aMCV1 coverage group, 2002–2009, World Health Organization (WHO) African Region. Confirmed measles cases are as reported by countries using measles case-based surveillance to the WHO African Regional Office. The overall line in each group represents all country-years; country-year-specific lines are given for those with  $\geq 30$  confirmed measles cases. aMCV1, moving average of the prior 10 years of WHO and United Nations Children's Fund estimates of coverage for the first dose of measles-containing vaccine.



**Figure 3.** Scatter plots of the estimated 10th, 25th, 50th, 75th, and 90th percentiles for age of confirmed measles cases ( $N = 72,062$ ) by the 10-year moving average of coverage estimates for the first dose of measles-containing vaccine for 118 country-years, 2002–2009, World Health Organization (WHO) African Region. The 10-year moving average refers to the moving average of the prior 10 years of WHO and United Nations Children's Fund estimates of coverage for the first dose of

average MCV1 coverage, the age distribution of cases shifted to older children and young adults. At the median and 75th percentile of cases, the age of infection increased with higher coverage; however, for infants, the age of infection decreased slightly with higher vaccination coverage. The shift to older children and adults has implications for disease burden estimates and may disproportionately lower the measles mortality burden relative to the morbidity burden, because previously described case fatality ratios are lower in older cases [37]. These findings may provide some evidence for estimating disease burden, constructing population susceptibility profiles, and defining target age for vaccination strategies and may guide further efforts toward measles mortality reduction and elimination in the region.

This study has several limitations. First, underreporting of measles cases is well documented [38, 39]; low sensitivity of measles case-based surveillance in some country-years likely led to underestimates of annual measles incidence in those country-years. Second, reporting efficiency might be higher in younger age groups with higher rates of complications and deaths; therefore, a differential in reporting efficiency among age groups could lead to underrepresentation of older cases and could bias the age distribution analysis. Third, the WHO UNICEF estimates of national MCV1 coverage used in our analysis were likely higher than the subnational MCV1 coverage in subpopulations where measles cases likely occurred. Fourth, our analysis did not account for MCV coverage achieved through SIAs; however, for each country, inclusion started in the first year following completion of the catch-up SIA, therefore limiting differences among countries in MCV coverage achieved through SIAs. Finally, reliable population denominators by age group were not available, and thus age-specific attack rates were not calculated, hence, it was possible that the observed shift in the age distribution of cases might have occurred because of general population dynamics.

The upward shift in the age of measles cases to older age groups with increasing MCV1 coverage is well documented in other settings [4, 40–42]. For example, toward the end of endemic measles virus transmission in the Americas, outbreaks in Argentina, Bolivia, Brazil, Canada, Venezuela, and the Dominican Republic included cases among young adults [42]. In 1997, the last large measles outbreak that occurred in the Americas in Sao Paolo, Brazil, included >42,000 cases and was caused by an accumulation of susceptible young children, because of suboptimal MCV1 coverage and a delay in implementing a follow-up SIA, together with an accumulation of susceptible young adults who had escaped both natural measles infection and measles vaccination [13].

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measles-containing vaccine. Confirmed measles cases are as reported by countries using measles case-based surveillance to the WHO African Regional Office. Country-years are from countries with  $\geq 30$  confirmed measles cases in a year during 2002–2009.

Although the observed shift in the age distribution of cases to younger ages in infants might have occurred in other settings, few published reports exist documenting this trend [43]. The possible age shift could be caused by a general increase in the proportion of infants who are susceptible to measles. Infants born to immune mothers receive maternal antibodies transferred during the perinatal period and remain protected, on average, until approximately 4–6 months of age [44]. However, in low-income settings, protection from maternal antibodies is lost at a younger age in infants [45]. In addition, transferred maternal antibodies that were vaccine-induced rather than naturally acquired following measles infection generally exist at lower geometric mean titers in the mother and infant and wane much earlier, leaving the infant unprotected as early as 1 month of age [46, 47]. Opportunities for naturally acquired antibodies decreased in most African countries following the sharp decreases in measles incidence that occurred after nationwide catch-up SIAs. In addition, a shift to younger age in infants might occur because of females reaching reproductive age without immunity. The emergence of measles infection in adults suggests there could be an increase in the proportion of infants born without maternal antibodies, especially during long interepidemic periods.

Catalytic models of measles dynamics that account for the variability of interepidemic periods following an increase in vaccination coverage indicate that, despite a change in the epidemic intervals, the relative force of infection for measles remains highest among children <5 years of age, and that cases in older age groups generally are overrepresented during large outbreaks [30, 44, 48, 49]. The scenario of young children exposed to a high force of infection living in households with susceptible young adults suggests the possibility of novel transmission patterns, unseen in the pre-vaccine era, that likely sustain virus circulation during large measles outbreaks in Africa today.

Although total fertility rates in African countries have decreased in recent years [50], they still rank among the highest in the world [35]. In addition to large birth cohorts in Africa, other factors including population movements due to modern urbanization, difficult access to areas of insecurity, vast geographic areas with poor infrastructure, and pastoralist nomadic populations present significant challenges to reaching all children with vaccination. Although the observed changes in measles epidemiology are an indication of progress, there remains a need to fully implement all components of the regional measles control strategy and to consider fine-tuning the strategies to sustain recent gains in measles mortality reduction and to make further progress.

The WHO and UNICEF Global Immunization Vision and Strategy for 2006–2015 [20], a framework to fight vaccine-preventable diseases, includes a framework of strategies for countries to achieve and sustain high (>90%) MCV1 coverage. The average national MCV1 coverage in 1996, at the start of the

first catch-up campaigns in the 7 southern African countries, was 80% and ranged from 61% in Namibia to 90% in Malawi. Ten years later, in 2006, the average was 86% (range, 62% in South Africa to 94% in Botswana and Swaziland) [24]. In 2000, when SIAs started throughout the rest of Africa, regional MCV1 coverage was 56% and increased to 73% in 2008 [24]. In contrast, at the start of the SIA strategy in the Americas in 1991, regional MCV1 coverage was 82% and increased to 92% in 2000 [24]; within 2 years, in 2002, regional measles elimination was declared [42].

Particular emphasis is needed in each country on implementing all components of the measles control strategy, including (1) increasing MCV1 coverage to  $\geq 90\%$  nationwide and in  $\geq 80\%$  of districts, (2) continuing to implement periodic SIAs that achieve high ( $>95\%$ ) coverage in all districts, (3) routinely monitoring and validating reported vaccination coverage, and (4) strengthening measles case-based surveillance in all districts. Outbreak response vaccination activities should routinely include infants starting at 6 months of age. Finally, further research is needed to better understand the changing measles epidemiology, including the role that young infants and older age groups play in sustaining measles virus transmission and in contributing to overall burden of disease in Africa.

## Acknowledgments

We acknowledge the great efforts of the immunization officers, surveillance medical officers, and measles laboratory staff throughout the African Region. We also thank the Measles Initiative for providing financial and operational support to member states, leading to measles mortality reduction and progress toward the measles pre-elimination goal in Africa.

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## References

1. World Health Organization. Measles vaccines: WHO position paper. *Wkly Epidemiol Rec* 2009; 84:349–60.
2. Edmunds WJ, Gay NJ, Kretzschmar M, et al. The pre-vaccination epidemiology of measles, mumps and rubella in Europe: implications for modelling studies. *Epidemiol Infect* 2000; 125:635–50.
3. World Health Organization. Measles reported cases. [http://www.who.int/immunization\\_monitoring/en/globalsummary/timeseries/tsincidencemea.htm](http://www.who.int/immunization_monitoring/en/globalsummary/timeseries/tsincidencemea.htm) 2008. Accessed 9 June 2010.
4. Cutts FT, Henderson RH, Clements CJ, Chen RT, Patriarca PA. Principles of measles control. World Health Organization. *Bull World Health Organ* 1991; 69:1–7.
5. Guyer B, McBean AM. The epidemiology and control of measles in Yaoundé, Cameroun, 1968–1975. *Int J Epidemiol* 1981; 10:263–9.
6. Heymann DL, Mayben GK, Murphy KR, Guyer B, Foster SO. Measles control in Yaounde: justification of a one dose, nine month minimum age vaccination policy in tropical Africa. *Lancet* 1983; 2:1470–72.
7. World Health Organization PAHO. Measles elimination in the Americas. *Bull Pan Am Health Organ* 1992; 26:271–4.
8. Ofosu-Amaah S. The control of measles in tropical Africa: a review of past and present efforts. *Rev Infect Dis* 1983; 5:546–53.
9. Keja K, Chan C, Hayden G, Henderson RH. Expanded programme on immunization. *World Health Stat Q* 1988; 41:59–63.
10. Chen RT, Weierbach R, Bisoffi Z, et al. A ‘post-honeymoon period’ measles outbreak in Muyinga sector. *Burundi Int J Epidemiol* 1994; 23:185–93.
11. Centers for Disease Control and Prevention. Global measles mortality, 2000–2008. *MMWR Morb Mortal Wkly Rep* 2009; 58:1321–6.
12. Anderson RM, May RM. Vaccination and herd immunity to infectious diseases. *Nature* 1985; 318:323–9.
13. Hersh BS, Tambini G, Nogueira AC, et al. Review of regional measles surveillance data in the Americas, 1996–99. *Lancet* 2000; 355:1943–8.
14. de Quadros CA, Olive JM, Hersh BS, et al. Measles elimination in the Americas: evolving strategies. *JAMA* 1996; 275:224–9.
15. Bielli R, Madema S, Taole A, et al. First 5 years of measles elimination in southern Africa: 1996–2000. *Lancet* 2002; 359:1564–8.
16. Uzicanin A, Eggers R, Webb E, et al. Impact of the 1996–1997 supplementary measles vaccination campaigns in South Africa. *Int J Epidemiol* 2002; 31:968–76.
17. World Health Organization. World health assembly resolution WHA 52.20, reducing global measles mortality. Geneva: WHO, 2003.
18. Centers for Disease Control and Prevention. Progress in global measles control and mortality reduction, 2000–2006. *Morb Mortal Wkly Rep* 2007; 56:1237–41.
19. Wolfsen LJ, Strebel PM, Gacic-Dobo M, et al. Has the 2005 measles mortality reduction goal been achieved? A natural history modelling study. *Lancet* 2007; 369:191–200.
20. World Health Organization and UNICEF. Global immunization vision and strategy. 2005. <http://www.who.int/immunization/givs/en/index.html>. Accessed 9 June 2010.
21. Bilous J, Eggers R, Gasse F, et al. A new global immunisation vision and strategy. *Lancet* 2006; 367:1464–6.
22. World Health Organization and UNICEF. Measles mortality reduction and regional elimination—strategic plan 2001–2005. <http://www.who.int/vaccines-documents/DocsPDF01/www573.pdf>. Accessed 9 June 2010.
23. Burton A, Monasch R, Lautenbach B, et al. WHO and UNICEF estimates of national infant immunization coverage: methods and processes. World Health Organization. *Bull World Health Organ* 2009; 87:535–41.
24. World Health Organization. WHO vaccine-preventable diseases: monitoring system 2008 global summary. Reported estimates of measles-vaccine containing vaccination coverage. <http://www.who.int/vaccines/globalsummary/immunization/timeseries/tscoveragegemcv.html>. 2008. Accessed 18 January 2010.
25. Centers for Disease Control and Prevention. Progress toward measles control—African region, 2001–2008. *MMWR Morb Mortal Wkly Rep* 2009; 58:1036–41.
26. Centers for Disease Control and Prevention. Effects of measles-control activities—African region, 1999–2005. *MMWR Morb Mortal Wkly Rep* 2006; 55:1017–21.
27. World Health Organization African Regional Office. Resolution AFR/RC59/14; 59th Session of the WHO regional committee for Africa: towards the elimination of measles in the African Region by 2020. <http://afrolib.afro.who.int/RC/RC59/en/AFR-RC59-19FinReportC.pdf>. 2009. Accessed 4 January 2010.
28. Centers for Disease Control and Prevention. Progress in measles control 2002–2007. *MMWR Morb Mortal Wkly Rep* 2007; 56:969–72.
29. Goodson J, Wiesen E, Perry R, et al. Impact of measles outbreak response vaccination campaign in Dar es Salaam, Tanzania. *Vaccine* 2009; 27:5870–4.
30. Ferrari MJ, Djibo A, Grais RF, Grenfell BT, Bjørnstad ON. Episodic outbreaks bias estimates of age-specific force of infection: a corrected method using measles as an example. *Epidemiol Infect* 2010; 138:108–16.
31. Centers for Disease Control and Prevention. Progress in measles control—Kenya 2002–2007. *MMWR Morb Mortal Wkly Rep* 2007; 56:969–72.
32. Yameogo KR, Perry RT, Yameogo A, et al. Migration as a risk factor for measles after a mass vaccination campaign, Burkina Faso, 2002. *Int J Epidemiol* 2005; 34:556–64.

33. World Health Organization African Regional Office. Measles surveillance guidelines. [http://www.afro.who.int/measles/guidelines/measles\\_surveillance\\_guideline\\_jan2006.pdf](http://www.afro.who.int/measles/guidelines/measles_surveillance_guideline_jan2006.pdf). 2006. Accessed 9 June 2010.
34. World Health Organization. Manual for the laboratory diagnosis of measles and rubella virus infection. [http://www.who.int/immunization\\_monitoring/LabManualFinal.pdf](http://www.who.int/immunization_monitoring/LabManualFinal.pdf). Accessed 9 June 2010.
35. United Nations Population Division. World population prospects: the 2008 revision. New York: United Nations, 2009. <http://esa.un.org/unpp>. Accessed 4 March 2010.
36. R Development Core Team. R: a language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing, 2009.
37. Wolfson LJ, Grais RF, Luquero FJ, Birmingham ME, Strebel PM. Estimates of measles case fatality ratios: a comprehensive review of community-based studies. *Int J Epidemiol* 2009; 38:192–205.
38. Odega CC, Fatiregun AA, Osagbemi GK. Completeness of suspected measles reporting in a southern district of Nigeria. *Public Health* 2010; 124:24–7.
39. Harpaz R. Completeness of measles case reporting: review of estimates for the United States. *J Infect Dis* 2004; 189(suppl 1):S185–90.
40. Cherry JD. The ‘new’ epidemiology of measles and rubella. *Hosp Pract* 1980; 15:49–57.
41. Duclos P, Redd SC, Varughese P, et al. Measles in adults in Canada and the United States: implications for measles elimination and eradication. *Int J Epidemiol* 1999; 28:141–6.
42. de Quadros CA, Izurieta H, Venczel L, et al. Measles eradication in the Americas: progress to date. *J Infect Dis* 2004; 189(suppl 1):S227–35.
43. Zhao H, Lu P-S, Hu Y, Wu Q, Yao W, Zhou Y-H. Low titers of measles antibody in mothers whose infants suffered from measles before eligible age for measles vaccination. *Virol J* 2010; 7:87–7.
44. Ferrari M, Grais R, Bharti N, et al. The dynamics of measles in sub-Saharan Africa. *Nature* 2008; 451:679–84.
45. Black FL, Berman LL, Borgoo JM, et al. Geographic variation in infant loss of maternal measles antibody and in prevalence of rubella antibody. *Am J Epidemiol* 1986; 124:442–52.
46. Cutts FT, Markowitz LE. Successes and failures in measles control. *J Infect Dis* 1994; 170(suppl 1):S32–41.
47. Leuridan E, Hens N, Hutse V, Ieven M, Aerts M, Van Damme P. Early waning of maternal measles antibodies in era of measles elimination: longitudinal study. *Br Med J* 2010; 340:c1626.
48. Grais RF, Conlan AJ, Ferrari MJ, et al. Time is of the essence: exploring a measles outbreak response vaccination in Niamey, Niger. *J R Soc Interface* 2007; 5:67–74.
49. Grais RF, Ferrari MJ, Dubray C, et al. Estimating transmission intensity for a measles epidemic in Niamey, Niger: lessons for intervention. *Trans R Soc Trop Med Hyg* 2006; 100:867–73.
50. Sneeringer SE. Fertility transition in sub-Saharan Africa: a comparative analysis of cohort trends in 30 countries. DHS comparative reports no. 23. Calverton, Maryland: ICF Macro, 2009.

# **Measles and Rubella Global Update March 2024**



**World Health  
Organization**

**IVB**

## **Distribution list**

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## **Disclaimer**

Please note that all data contained within is provisional. The number of cases of measles and rubella officially reported by a member state is only available by July of each year (through the joint WHO UNICEF annual data collection exercise). If any numbers from this provisional data are quoted, they should be properly sourced with a date (i.e. "provisional data based on monthly data reported to WHO (Geneva) as of March 2024"). For official data from 1980–2023, please visit our website.

# Data sources and limitations

The Global Measles and Rubella Report is based on surveillance data reported by Member States to the regional offices weekly or monthly. The regional compilation is reported to HQ monthly. Data are to be reported from the regions on the 1<sup>st</sup> Friday of the month, and HQ attempts to release the monthly report by the 3<sup>rd</sup> Monday of the month.

## Please note:

- Numbers of cases might differ from the official numbers reported annually as part of the WHO/UNICEF Joint reporting process (JRF). The difference can be due to the time lag as the annual data might not be complete at the time of reporting.
- In addition, the difference can be due to multiple surveillance systems at country level. In these cases, the monthly data are extracted from the case based surveillance system while the annual data can be from the aggregated system.

## Epidemiologic Data: Case-based and/or Aggregate Reporting to WHO

- Epidemiologic data comes from Member States in one of two forms
  - Case-based data, which is our recommendation, is provided by most member states. At WHO HQ, we collect a limited set of variables, including, age, date of onset, country reporting, 1<sup>st</sup>/2<sup>nd</sup> administrative unit of residence, vaccination status (by recall), date related to specimen collection/testing, and final classification. Regions might or might not collect more data than this. Often suspected cases with recent date of onset are not classified; however, at HQ we classify pending cases as clinically compatible and update the data if/when new data are provided to HQ. For AFR, we classify all cases that are rubella IgM+ as rubella laboratory-confirmed cases.
  - Aggregated data on number of suspected, lab-confirmed, epi-linked, and clinically compatible cases of measles/rubella, by month/year of onset, and by subnational area (though some member states do not provide this level of disaggregation).
    - Source for zero-reporting from some member-states though this is not a consistent process.
- A few member states send us both case-based and aggregated data as they have two different surveillance systems in the country.
  - If both aggregate and case-based data are sent to HQ, numbers from aggregate surveillance are considered case counts for the country, while case-based data are used for the national slides to show age distribution, proportion vaccinated, and age-specific incidence.

## Limitations

- Reporting delays: It can take 2–3 months from the time a case is reported to public health in a member state to the time the data are provided to WHO HQ.
  - Some of this is due to normal reporting delays that are expected as it takes time to get information from a health center to Geneva based on reporting frequencies set by various levels
  - We are working to decrease the delays in reporting.
- Underreporting/lack of reporting
- Case definitions for suspect, epidemiologically linked and clinically compatible cases may vary between countries.
- Completeness of the data reported to WHO is unknown
- For this monthly update, pending cases are considered measles clinically compatible.
  - These cases may later be discarded or confirmed based on laboratory testing in which case historical case counts may vary from one report to another.
  - This could lead to differences between the Global monthly report and Regional or National surveillance bulletins published by WHO Offices and National authorities.

## ELISA Laboratory Data from the Global Measles and Rubella Laboratory Network (GMRLN)

- The Global Measles Rubella Laboratory Network laboratories report the number of samples received as well as the number of samples tested for IgM serology, as well as the number positive, negative and equivocal.
  - These aggregated data are collected to account for the inadequate linking between laboratory and epidemiological data in some countries.
  - Numbers of cases reported may differ from the number of samples tested positive for various reasons
    - Samples tested positive in a laboratory may not be reported to the surveillance system
    - IgG screening results are appropriately included in the surveillance database
    - Inconsistent reporting from laboratories.
    - This is based on the number of SAMPLES tested, not the number of CASES tested. One case can have multiple samples being tested (e.g. different specimen types, repeat specimen collection based on timing of collection).

## Limitations

- Data are only from network laboratories
- Non-network laboratories are not included
- Some laboratories don't report
- IgG results are sometimes appropriately reported

## Genotyping Data

Genotyping data are obtained from the MeaNS2 (<https://who-gmrln.org/means2>) and RubeNS2 (<https://who-gmrln.org/rubens2>).

## Limitations

- Inadequate sample collection for genotyping challenges interpretation of the data
- Underreporting
  - WHO recommends that Member States submit genotyping data to these databases, but it is not currently a requirement so there is underreporting
- Genotype data can't be linked to epidemiologic data at the global level

**Measles**



**World Health  
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# Number of reported measles cases by WHO Region

**2024**

Region	Member States*	Suspected cases	Measles cases	Clin	Epi	Lab	Date Received
AFR	32/47	7,015	4,907	572	2,965	1,370	2024-03
AMR	18/35	916	47	0	0	47	2024-03
EMR	13/21	9,284	7,077	4,629	637	1,811	2024-03
EUR	0/53	0	0	0	0	0	2024-03
SEAR	10/11	11,982	5,011	3,166	392	1,453	2024-03
WPR	21/27	1,949	350	23	12	315	2024-03
<b>Total</b>	<b>96/194</b>	<b>31,146</b>	<b>17,392</b>	<b>8,390</b>	<b>4,006</b>	<b>4,996</b>	

Region	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
AFR	3,876	1,031	0	0	0	0	0	0	0	0	0	0
AMR	13	34	0	0	0	0	0	0	0	0	0	0
EMR	5,659	1,418	0	0	0	0	0	0	0	0	0	0
EUR	0	0	0	0	0	0	0	0	0	0	0	0
SEAR	3,475	1,536	0	0	0	0	0	0	0	0	0	0
WPR	350	0	0	0	0	0	0	0	0	0	0	0
<b>Total</b>	<b>13,373</b>	<b>4,019</b>	<b>0</b>									

**2023**

Region	Member States*	Suspected cases	Measles cases	Clin	Epi	Lab	Date Received
AFR	43/47	115,900	69,797	7,276	40,754	21,767	2024-03
AMR	28/35	10,599	49	0	0	49	2024-03
EMR	21/21	138,323	88,773	51,453	8,394	28,926	2024-03
EUR	43/53	69,288	60,861	9,564	10,088	41,209	2024-03
SEAR	11/11	201,024	90,968	20,521	23,590	46,857	2024-03
WPR	25/27	55,983	5,094	2,261	193	2,640	2024-03
<b>Total</b>	<b>171/194</b>	<b>591,117</b>	<b>315,542</b>	<b>91,075</b>	<b>83,019</b>	<b>141,448</b>	

Region	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
AFR	7,117	8,360	9,634	8,519	8,682	5,747	4,183	4,968	4,731	4,378	2,442	1,036
AMR	1	5	0	5	5	5	0	7	2	7	12	0
EMR	6,123	8,246	9,220	6,998	10,548	9,254	9,303	7,337	6,639	5,555	5,189	4,361
EUR	541	1,017	1,583	2,070	3,365	4,143	4,139	4,115	5,739	8,273	8,191	17,685
SEAR	16,754	14,203	15,174	11,358	8,227	5,274	3,701	4,225	3,240	2,707	3,369	2,736
WPR	97	193	222	289	352	330	400	494	761	902	734	320
<b>Total</b>	<b>30,633</b>	<b>32,024</b>	<b>35,833</b>	<b>29,239</b>	<b>31,179</b>	<b>24,753</b>	<b>21,726</b>	<b>21,146</b>	<b>21,112</b>	<b>21,822</b>	<b>19,937</b>	<b>26,138</b>

Notes: Based on data received 2024-03 - This is surveillance data, hence for the last month, the data may be incomplete. \* Member States Reporting / Total Member States in Region

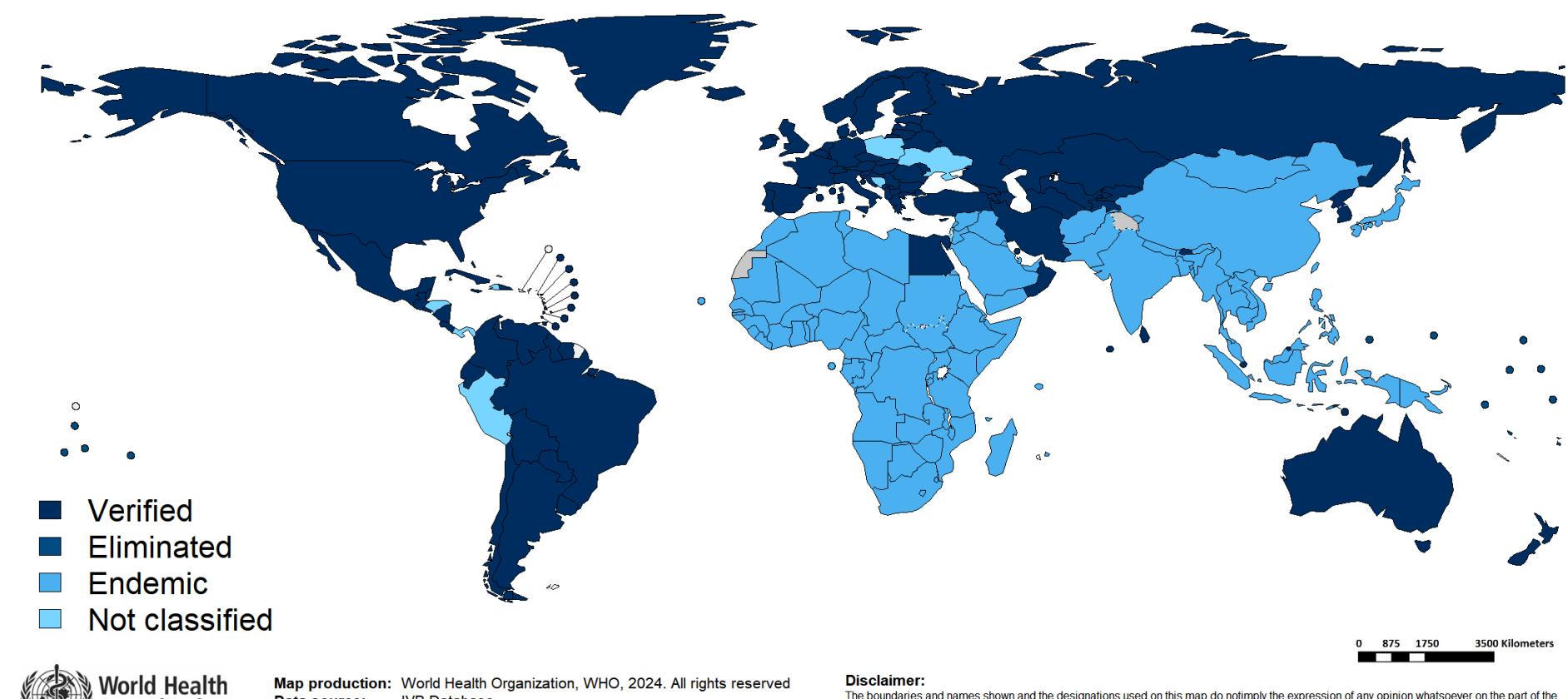
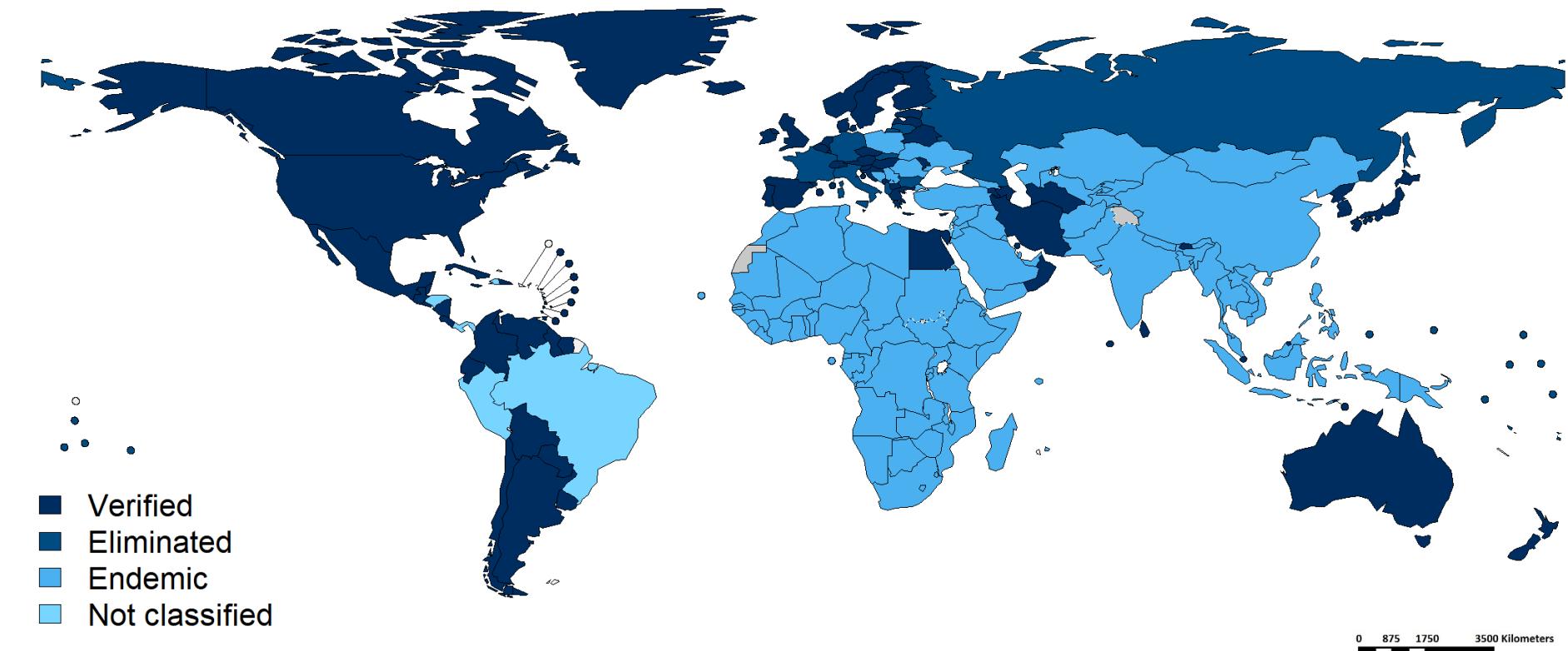
# Measles/rubella verification of elimination

## Measles

Region	Member States	Verified	% Verified	Eliminated	Endemic	Not classified
AFR	47	0	0	0	47	0
AMR	35	30	86	0	0	5
EMR	21	4	19	0	17	0
EUR	53	33	62	8	11	1
SEAR	11	5	45	0	6	0
WPR	27	6	22	13	8	0
<b>GLOBAL</b>	<b>194</b>	<b>78</b>	<b>40</b>	<b>21</b>	<b>89</b>	<b>6</b>

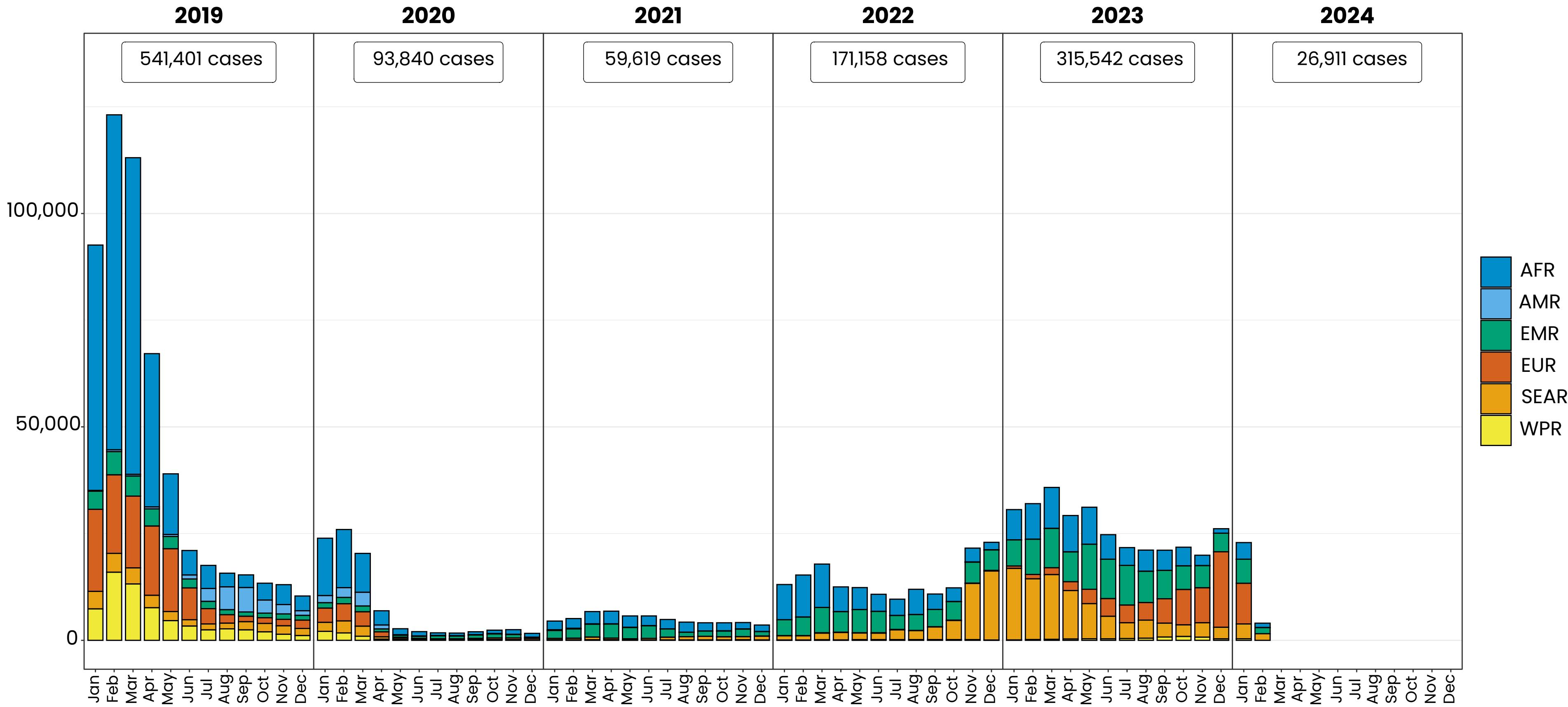
## Rubella

Region	Member States	Verified	% Verified	Eliminated	Endemic	Not classified
AFR	47	0	0	0	47	0
AMR	35	31	89	0	0	4
EMR	21	4	19	0	17	0
EUR	53	49	92	0	0	4
SEAR	11	5	45	0	6	0
WPR	27	5	19	13	9	0
<b>GLOBAL</b>	<b>194</b>	<b>94</b>	<b>48</b>	<b>13</b>	<b>79</b>	<b>8</b>



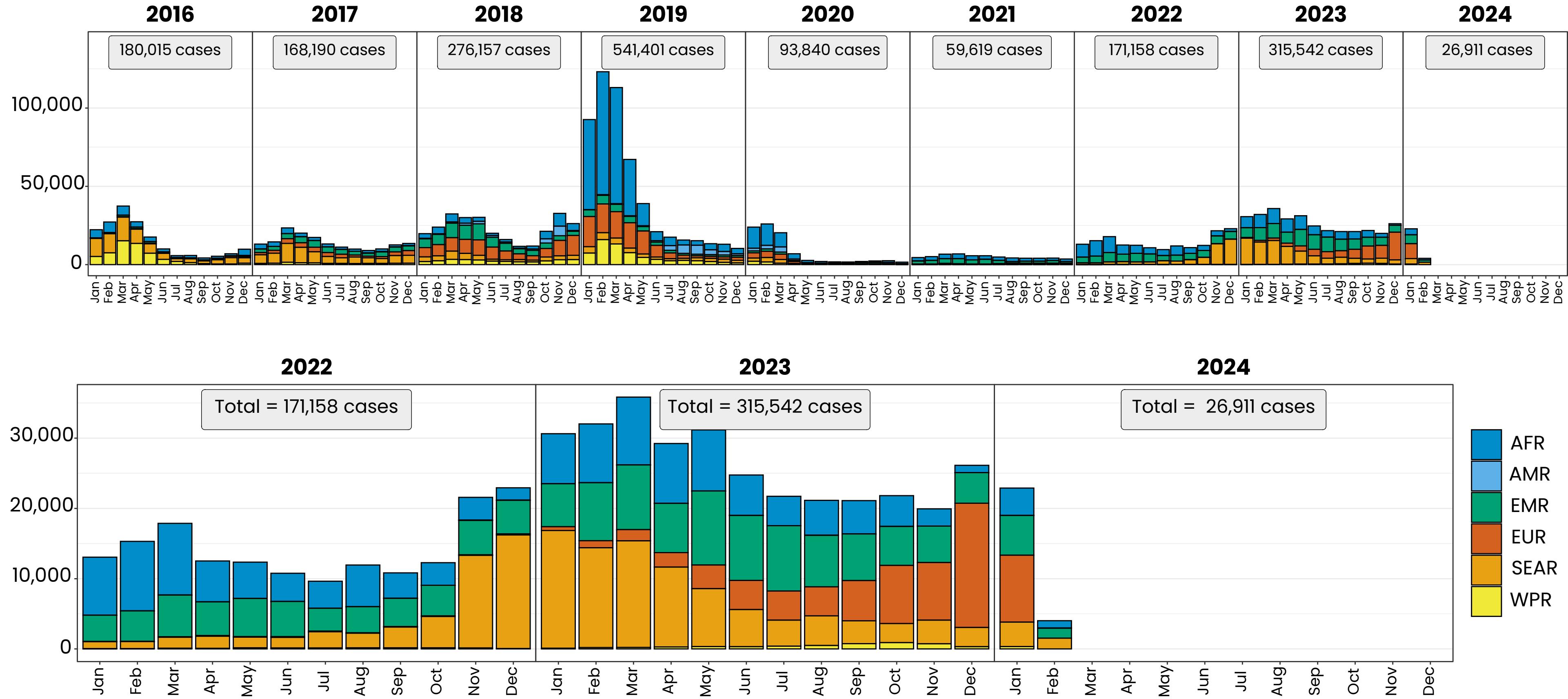
Notes: Based on data available at WHO HQ as of 2024-03-08. Terms used on this slide refer to the global framework for the verification of measles and rubella elimination. These terms might differ from those used by WHO Regional Offices. Verified = Elimination verified by Regional Verification Committee (RVC); Eliminated = Eliminated transmission but no RVC verification yet.

# Measles case distribution by month and WHO Region (2019–2024)



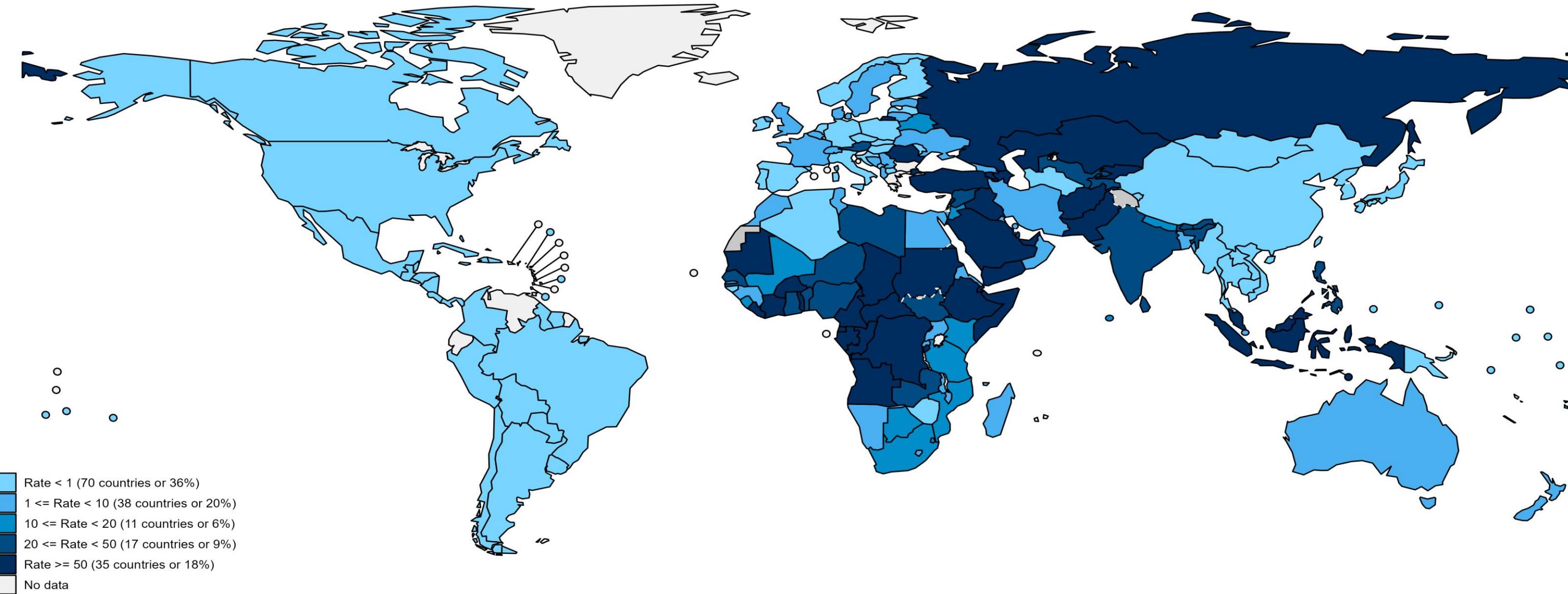
Notes: Based on data received 2024-03 – Data Source: IVB Database – This is surveillance data, hence for the last month(s), the data may be incomplete.

# Measles case distribution by month and WHO Region (2016–2024)



Notes: Based on data received 2024-03 – Data Source: IVB Database – This is surveillance data, hence for the last month(s), the data may be incomplete.

# Measles Incidence Rate per Million (12M period)



Map production: World Health Organization, 2024. All rights reserved  
Data source: IVB Database

**Disclaimer:** The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

0 875 1750 3500 Kilometers

## Highest incidence rates

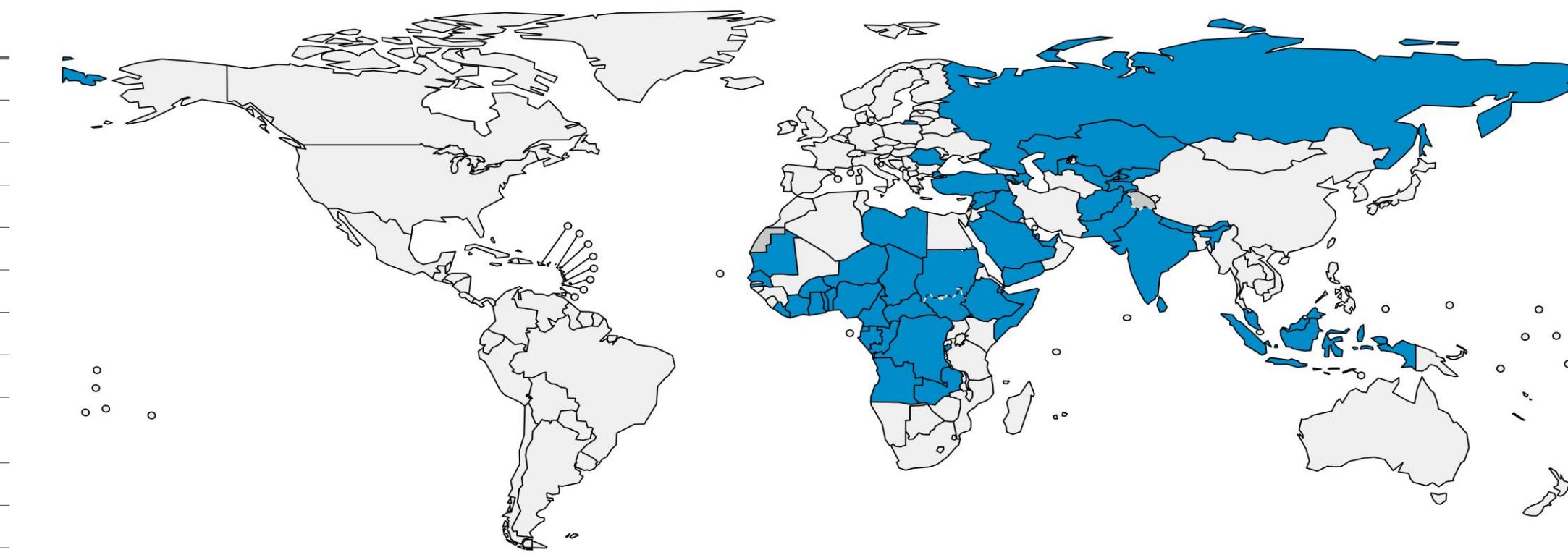
Country	Cases	Rate
Azerbaijan	13728	1,318.40
Yemen	43998	1,277.16
Kazakhstan	24621	1,255.75
Kyrgyzstan	7459	1,107.44
Liberia	3442	635.25
Iraq	14336	315.05
Gabon	733	300.83
Central African Republic	1499	261.04
Armenia	555	199.79
Cameroon	5635	196.70

# Immunization Agenda 2030 - Impact Goal 1.3

Countries provisionally meeting the large and disruptive outbreaks definition - Data from 2022-11 to 2023-10 included

Country	Cases	Rate/M	Clinical*
Yemen	51,168	1,485.29	89%
Gabon	1,941	796.61	0%
Liberia	3,904	720.51	5%
Kazakhstan	12,304	627.54	2%
Kyrgyzstan	4,141	614.82	26%
Central African Republic	1,527	265.92	0%
Cameroon	6,598	230.32	1%
Somalia	3,731	205.64	60%
Armenia	494	177.83	0%
Equatorial Guinea	232	135.30	6%
Ethiopia	16,366	129.35	0%
Iraq	5,055	111.09	68%
DR Congo	10,961	107.18	1%
Sudan	4,513	93.81	9%
Djibouti	102	89.75	10%
Angola	2,891	78.81	1%
Togo	689	76.10	8%
Chad	1,390	76.05	17%
Burundi	1,004	75.84	12%
Romania	1,457	73.24	1%
Indonesia	19,830	71.45	44%
Russian Federation	9,836	68.10	1%
Pakistan	16,357	68.02	9%
Afghanistan	2,839	67.21	2%

Country	Cases	Rate/M	Clinical*
Lebanon	350	65.37	43%
India	92,220	64.55	13%
Congo	376	61.57	2%
Mauritania	291	59.84	0%
Saudi Arabia	2,083	56.38	0%
Türkiye	4,606	53.67	0%
Nigeria	11,980	53.53	53%
South Sudan	576	51.94	5%
United Arab Emirates	470	49.39	8%
Qatar	119	43.81	3%
Zambia	789	38.36	9%
Côte d'Ivoire	1,094	37.89	0%
Malaysia	1,289	37.57	1%
Senegal	657	36.99	10%
Ghana	1,246	36.52	3%
Nepal	1,069	34.60	3%
Syrian Arab Republic	789	33.97	0%
Tajikistan	344	33.91	0%
Sri Lanka	713	32.57	4%
Benin	406	29.61	4%
Burkina Faso	657	28.26	10%
Libya	187	27.15	0%
Niger	719	26.43	8%
Azerbaijan	265	25.45	22%



Map production: World Health Organization, 2024. All rights reserved  
Data source: IVB Database

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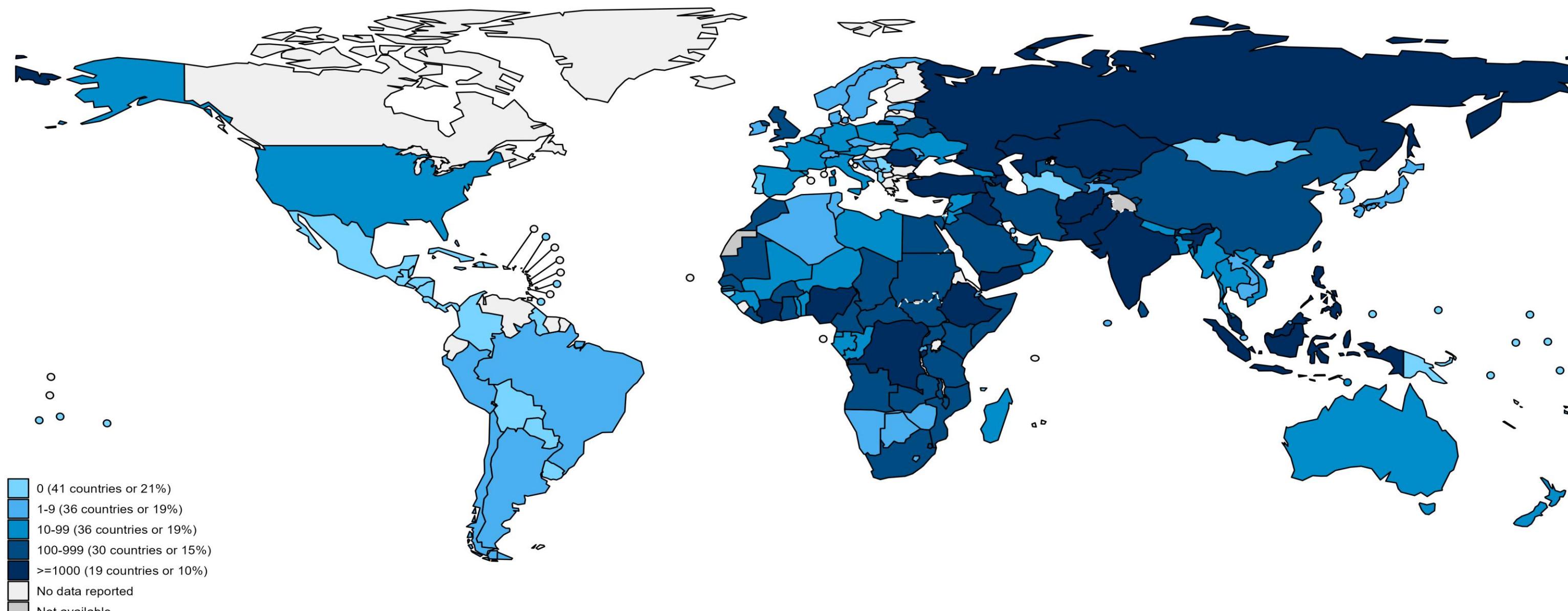
0 875 1750 3500 Kilometers

Total: 49 countries

In the frame of tracking progress towards the goals of Immunization Agenda 2030 (IA2030), an indicator has been developed by a working group in order to represent large and disruptive measles outbreaks. This indicator is defined as an incidence equal or greater than 20 reported measles cases per million population over a period of 12 months. It is important to note that measles outbreak definitions vary between countries and regions according to local context and level of progress towards regional elimination goals. This definition of large and disruptive outbreaks aims to complement and not replace the national and regional definitions, while also providing a degree of global standardization and permitting tracking of progress against a common metric.

Notes: Based on data received 2024-03 and covering the period between 2022-11 and 2023-10 - Incidence: Number of cases / 1M population - Population Data: World population prospects, 2019 revision - A high proportion of clinical cases indicates a high level of uncertainty associated with the incidence rates and the inclusion of countries in this list.

# Number of Reported Measles Cases (Last 6 months)

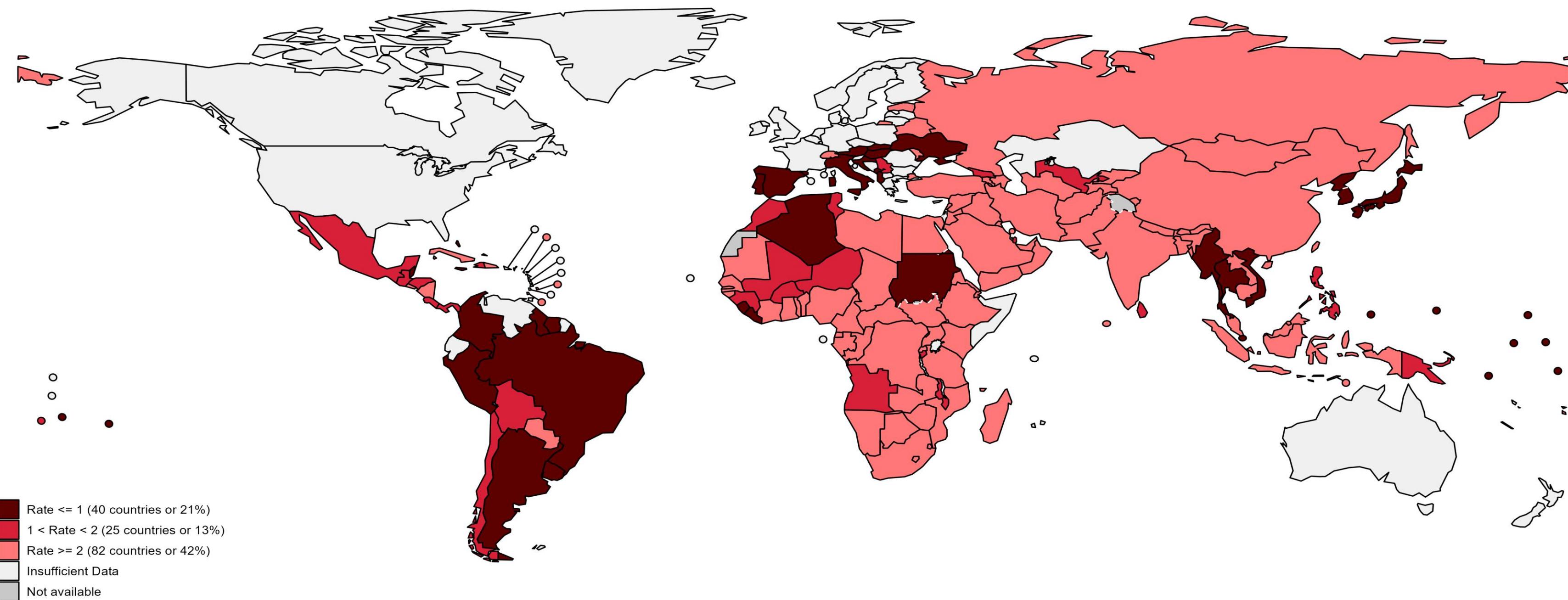


Map production: World Health Organization, 2024. All rights reserved  
Data source: IVB Database

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0 875 1750 3500 Kilometers

# Surveillance sensitivity reporting rate of measles and rubella (12 months, discarded cases\* per 100,000 population)



Map production: World Health Organization, 2024. All rights reserved  
Data source: IVB Database

**Disclaimer:** The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

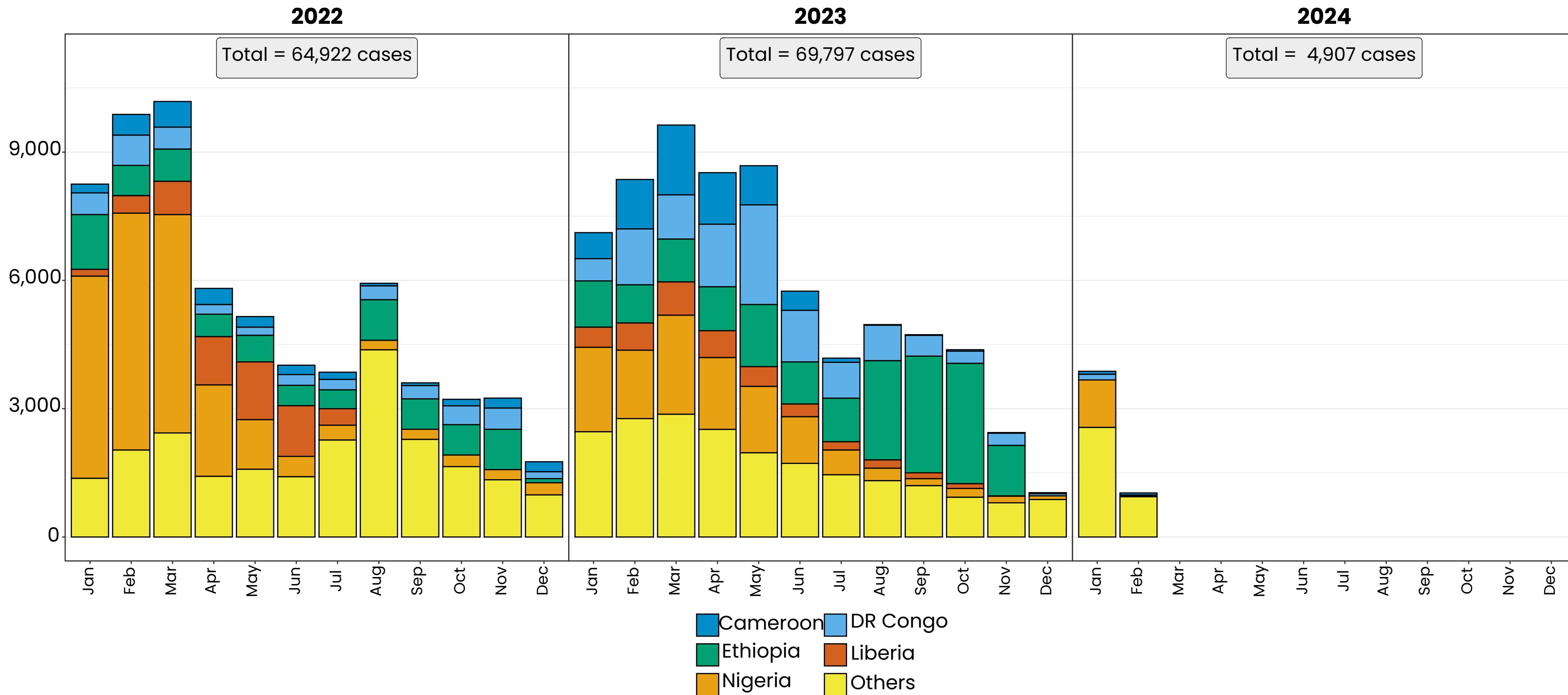
0 875 1750 3500 Kilometers

# Disclaimer

This document contains data provided to WHO by member states. Note that some member states only provide aggregate data to WHO, and for these, we are unable to generate a country profile. Some member states report all cases at one time point for the entire year, and thus epidemiologic curves generated are not accurate and a reporting artifact. For some countries, cases are reported by age category, not by exact age in months and/or years. Thus, age distribution/incidence is approximate. Cases classified as pending by countries are classified at WHO as clinically compatible at this time, and thus numbers might differ between data shown here and provided by the member state or WHO country/regional offices.

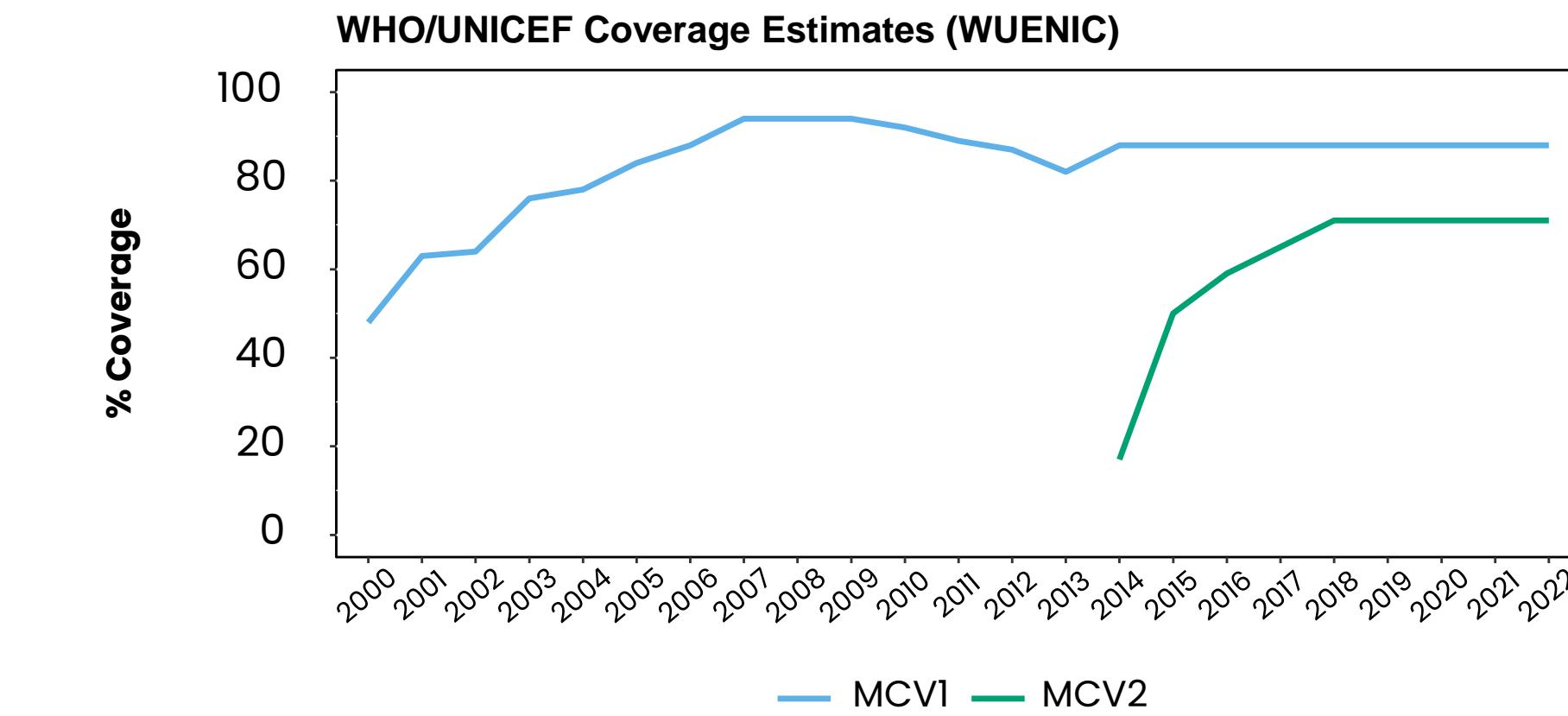
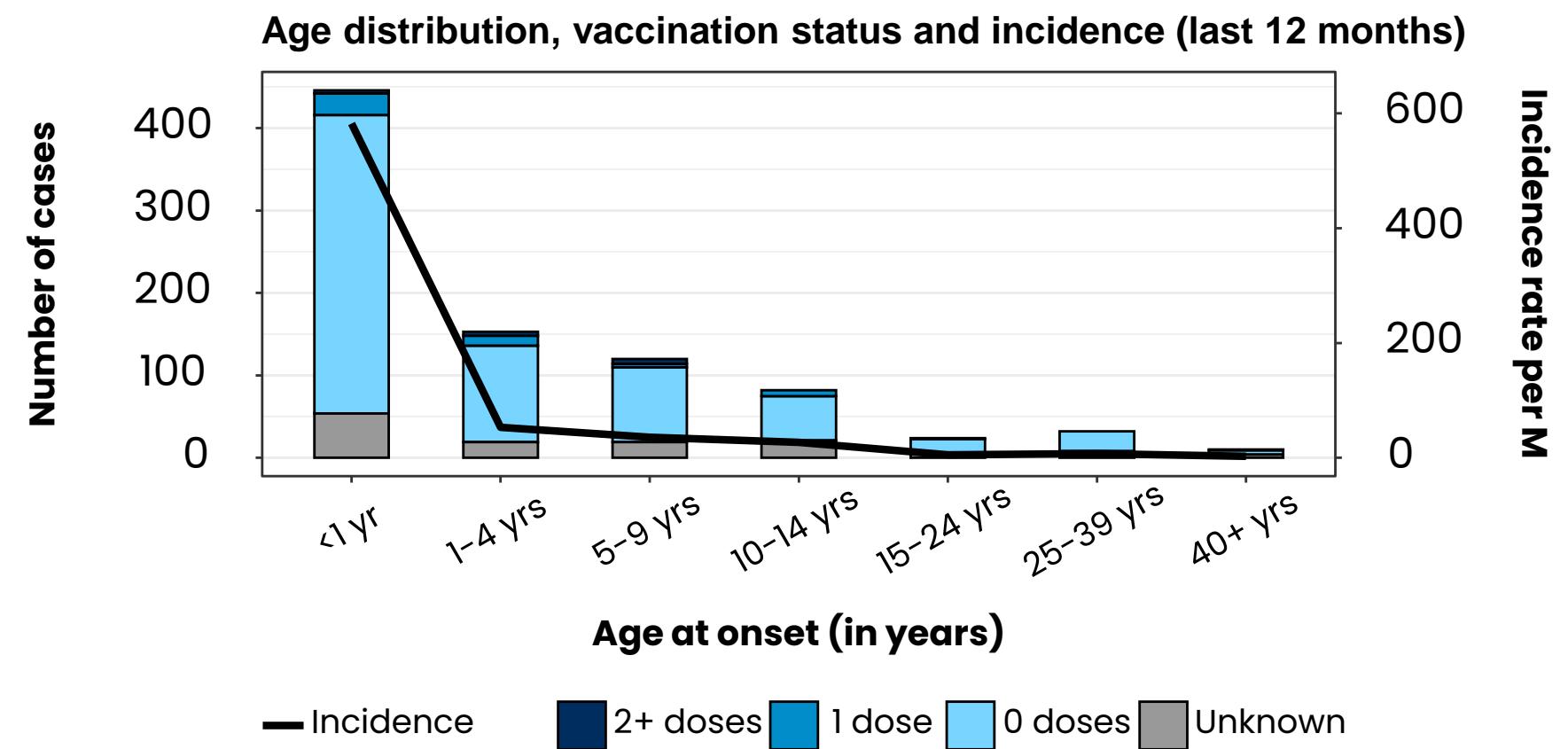
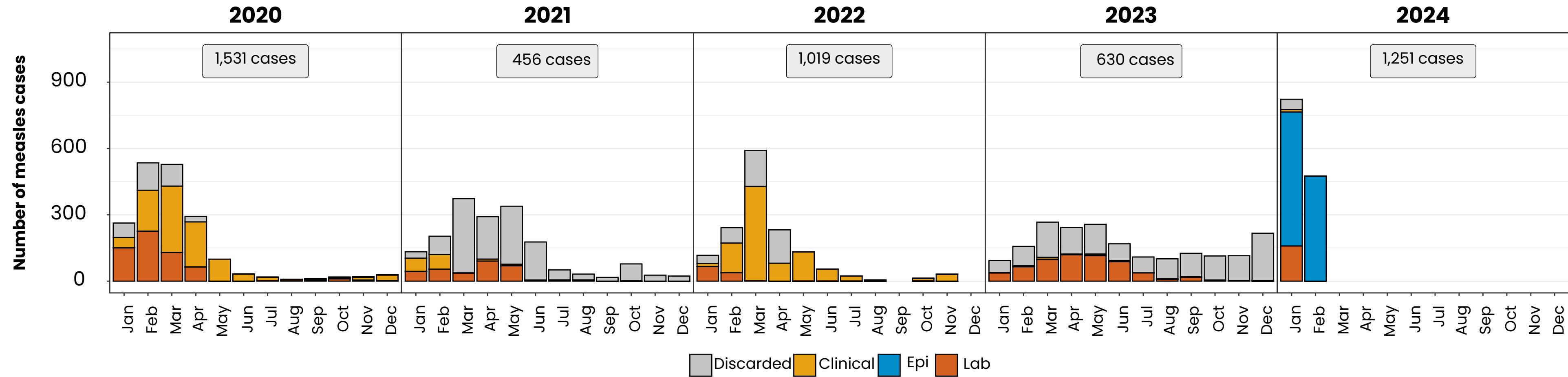
\*UN population data is used as the denominator for calculating incidence.

# Measles case distribution (AFR), 2022–2024



# Measles cases: Burkina Faso

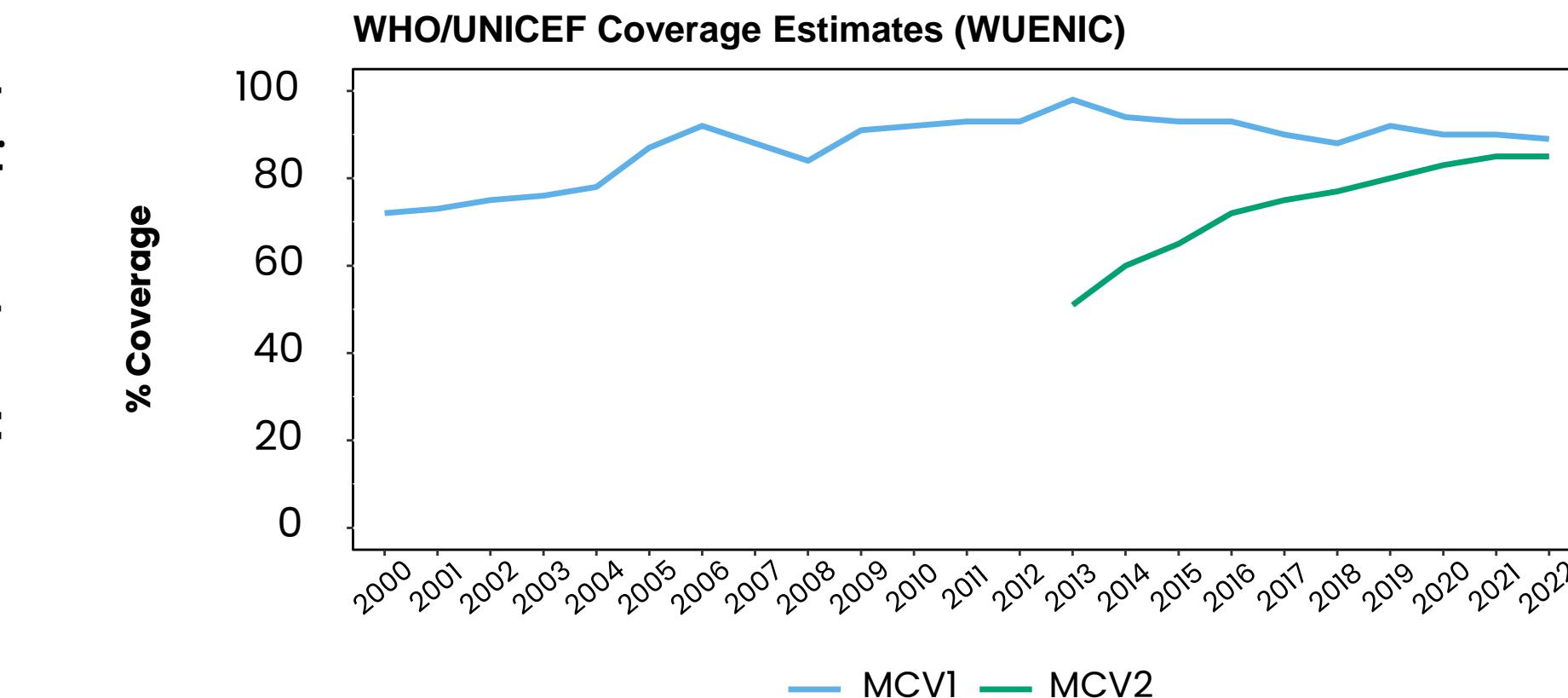
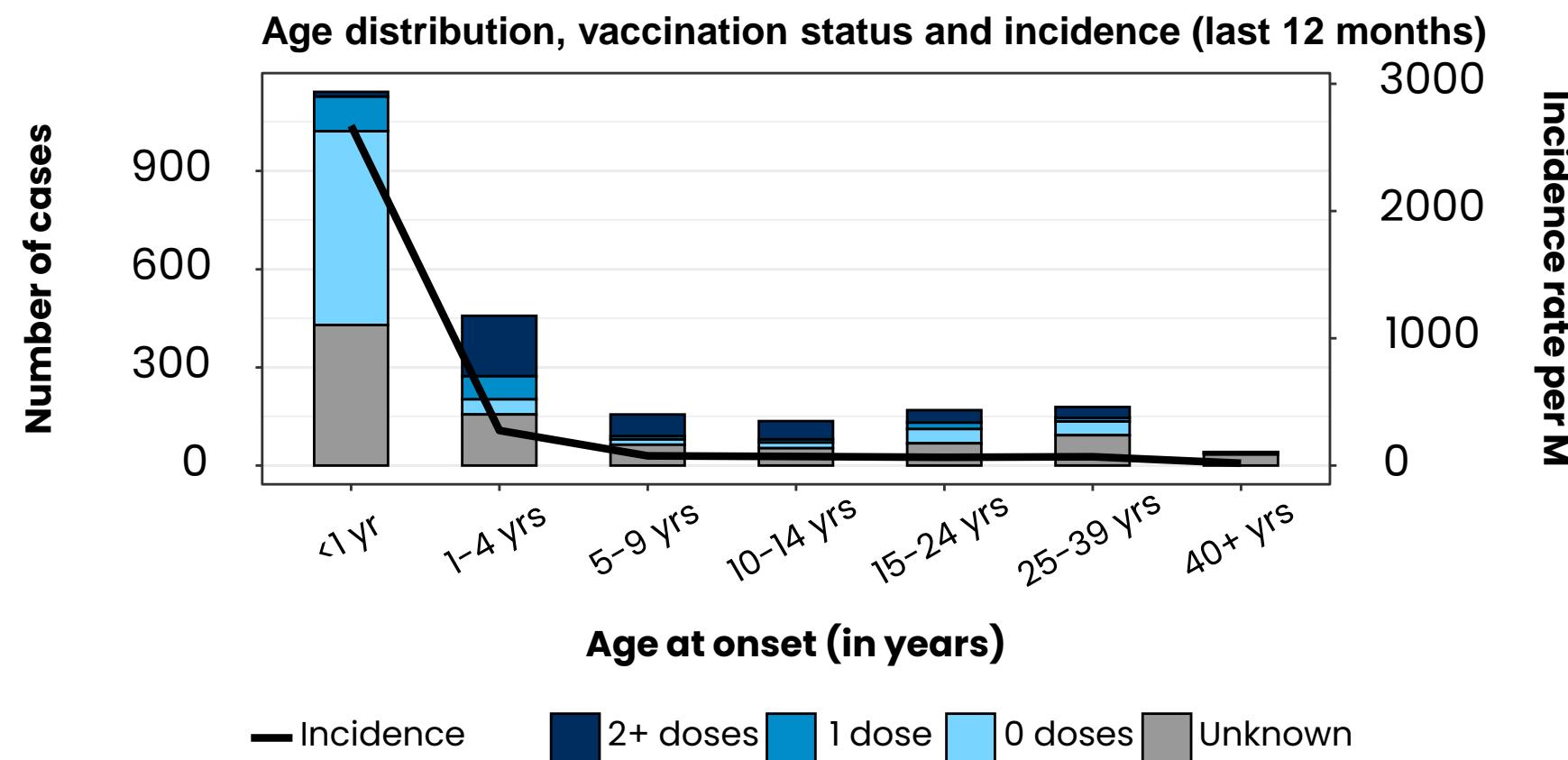
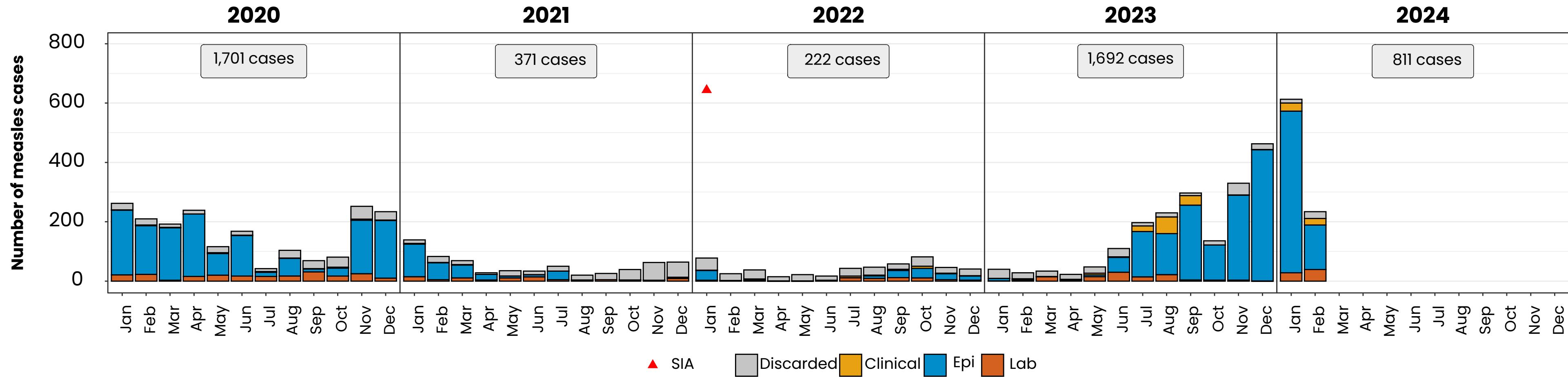
ELIMINATION STATUS: **ENDEMIC**



Based on data received 2024-03 - Data Source: IVB Database. Main epi curve was built using case-based surveillance data. Age distribution curve was built using case-based surveillance data. Coverage data from WHO/UNICEF Estimates of National Immunization Coverage (WUENIC)

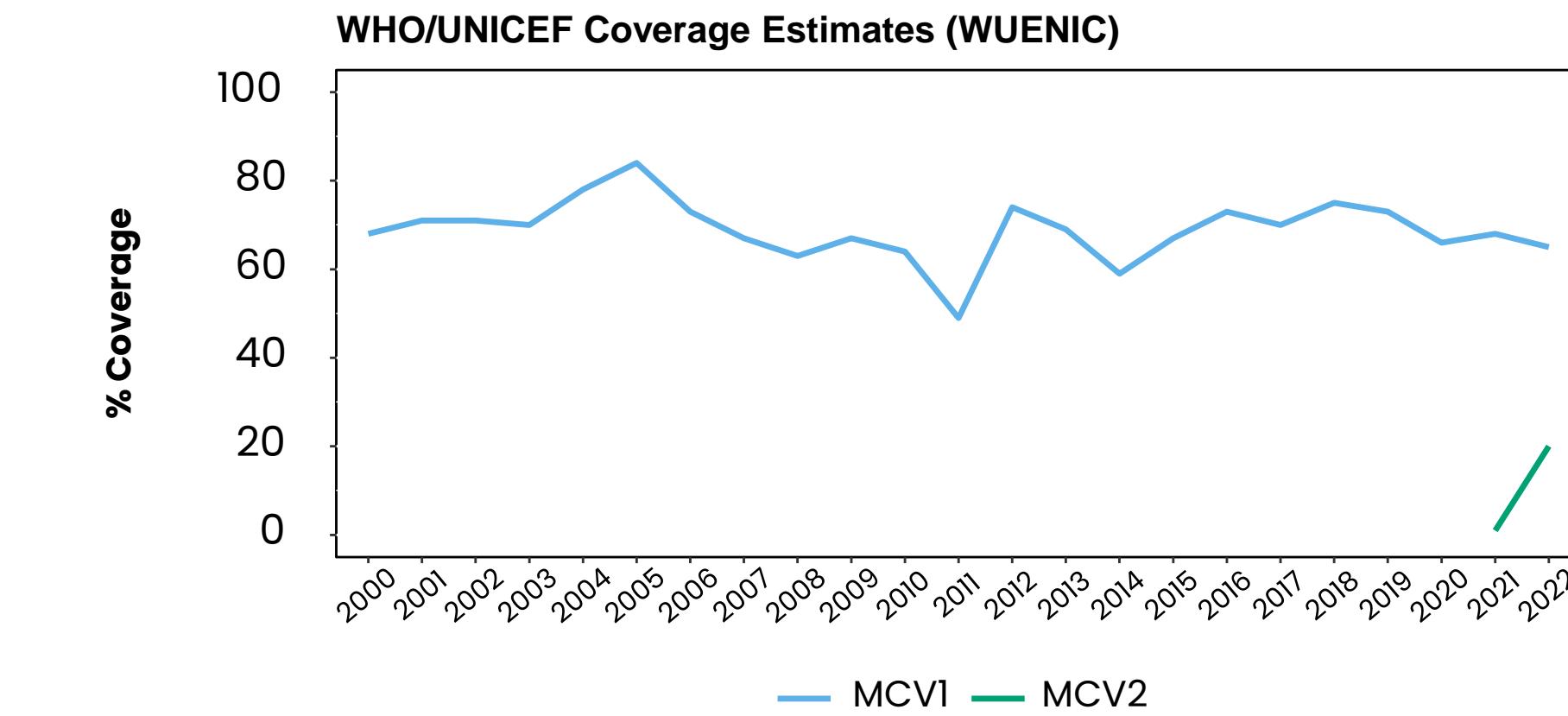
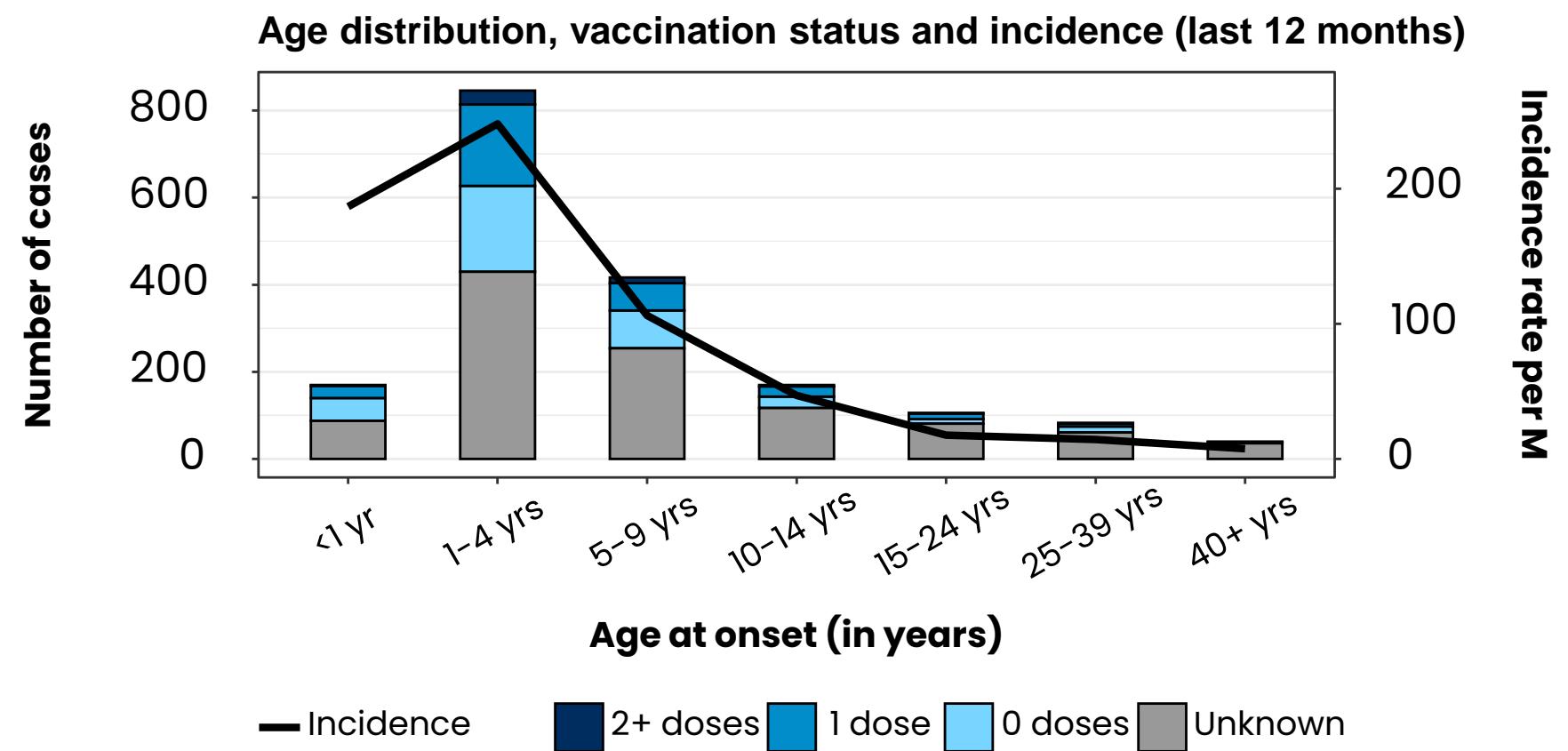
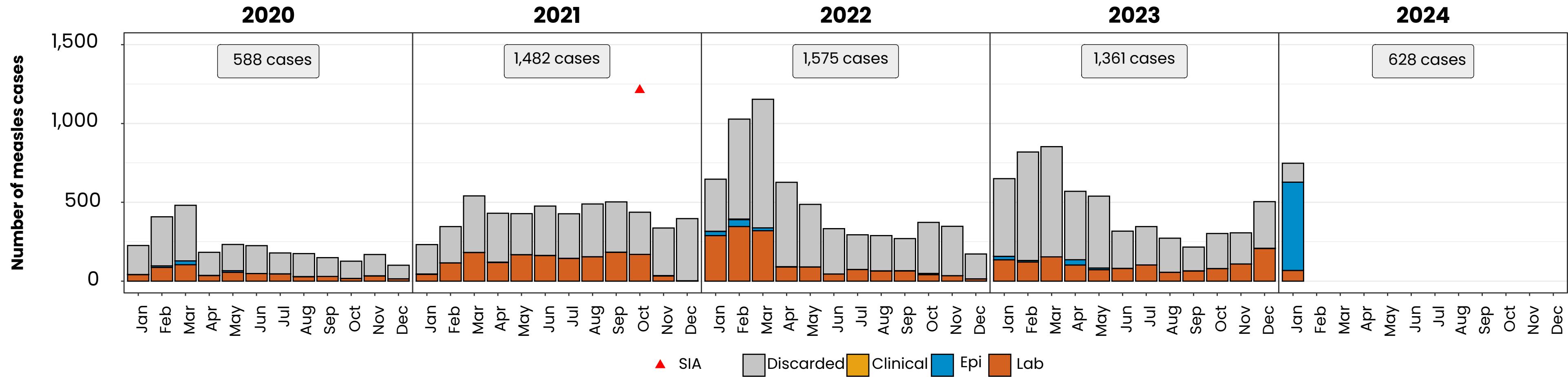
# Measles cases: Burundi

ELIMINATION STATUS: **ENDEMIC**



# Measles cases: Côte d'Ivoire

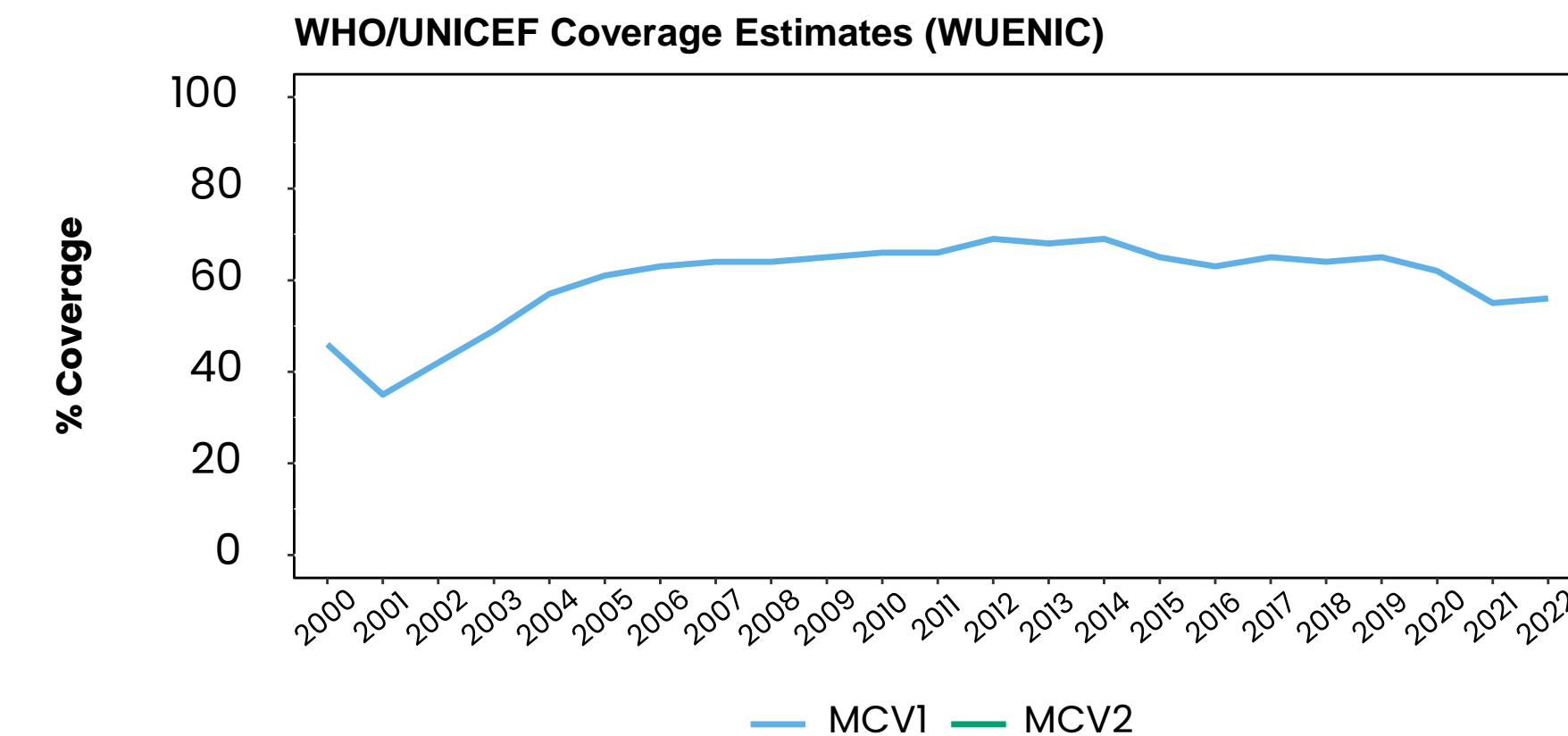
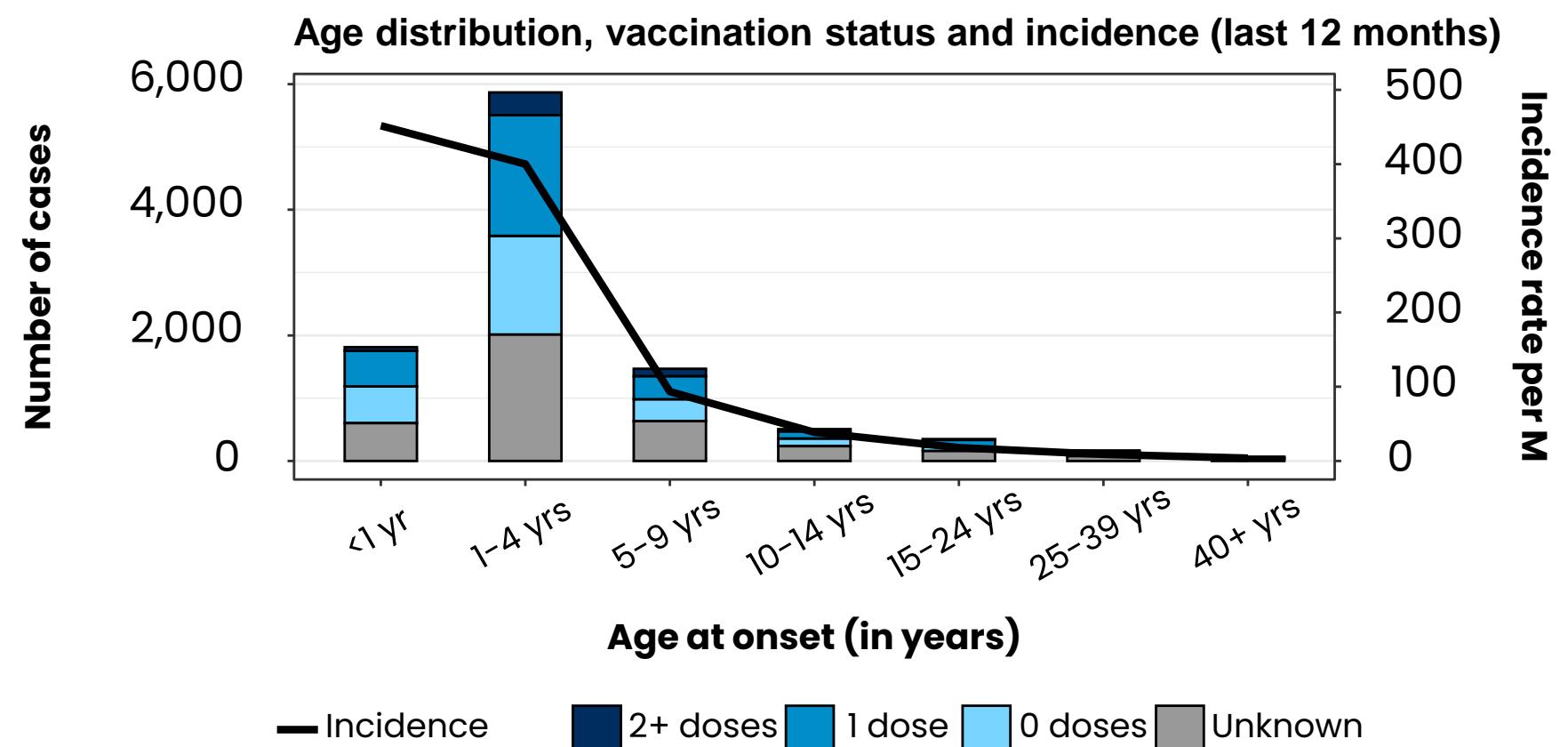
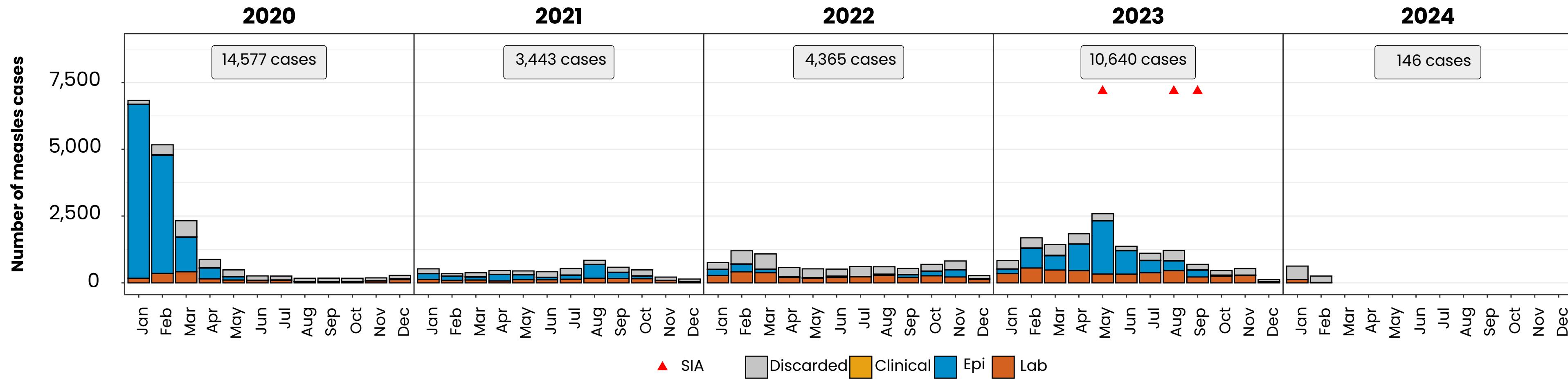
ELIMINATION STATUS: **ENDEMIC**



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# Measles cases: Democratic Republic of the Congo

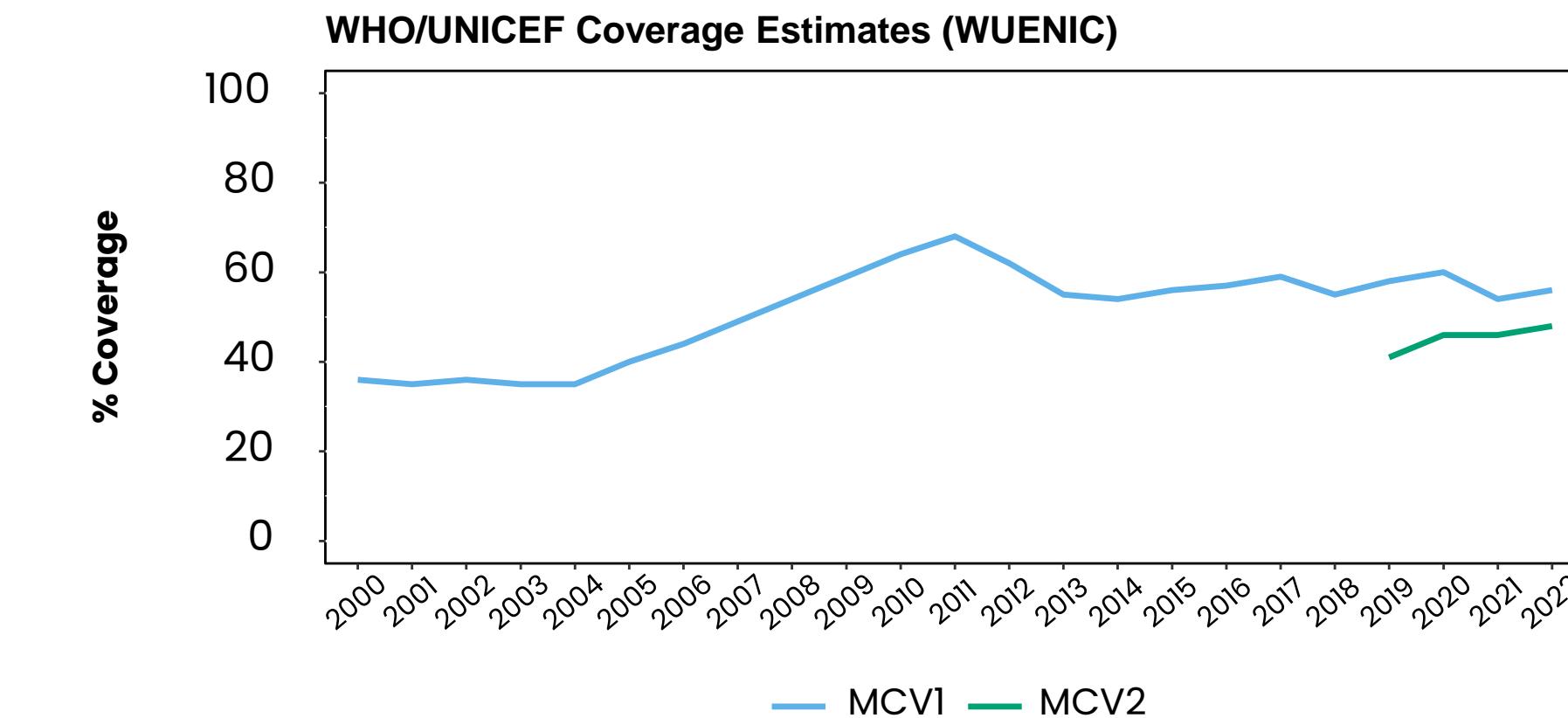
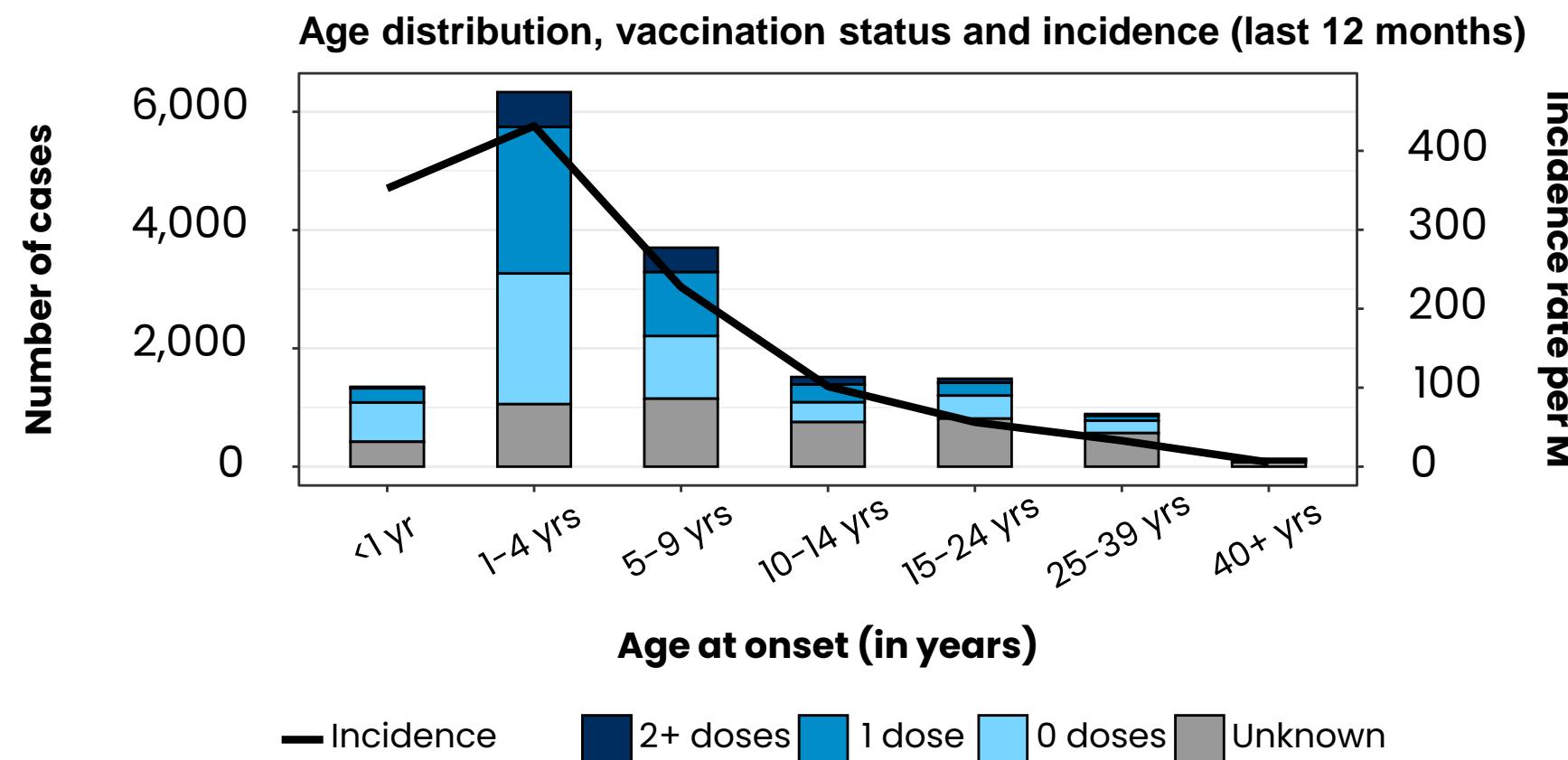
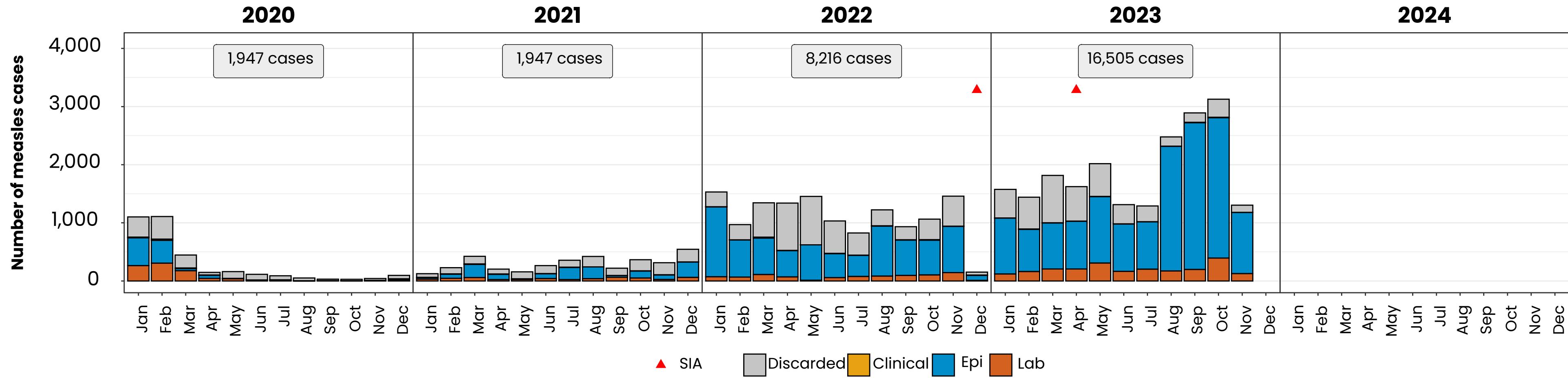
# ELIMINATION STATUS: **ENDEMIC**



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# Measles cases: Ethiopia

ELIMINATION STATUS: **ENDEMIC**



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# Measles cases: Nigeria

ELIMINATION STATUS: **ENDEMIC**

**2020**

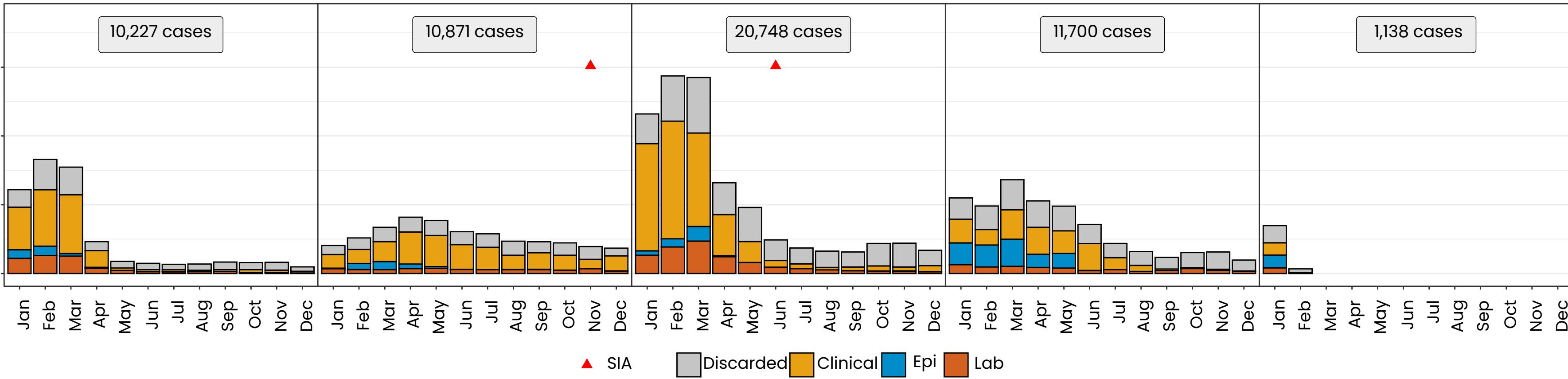
**2021**

**2022**

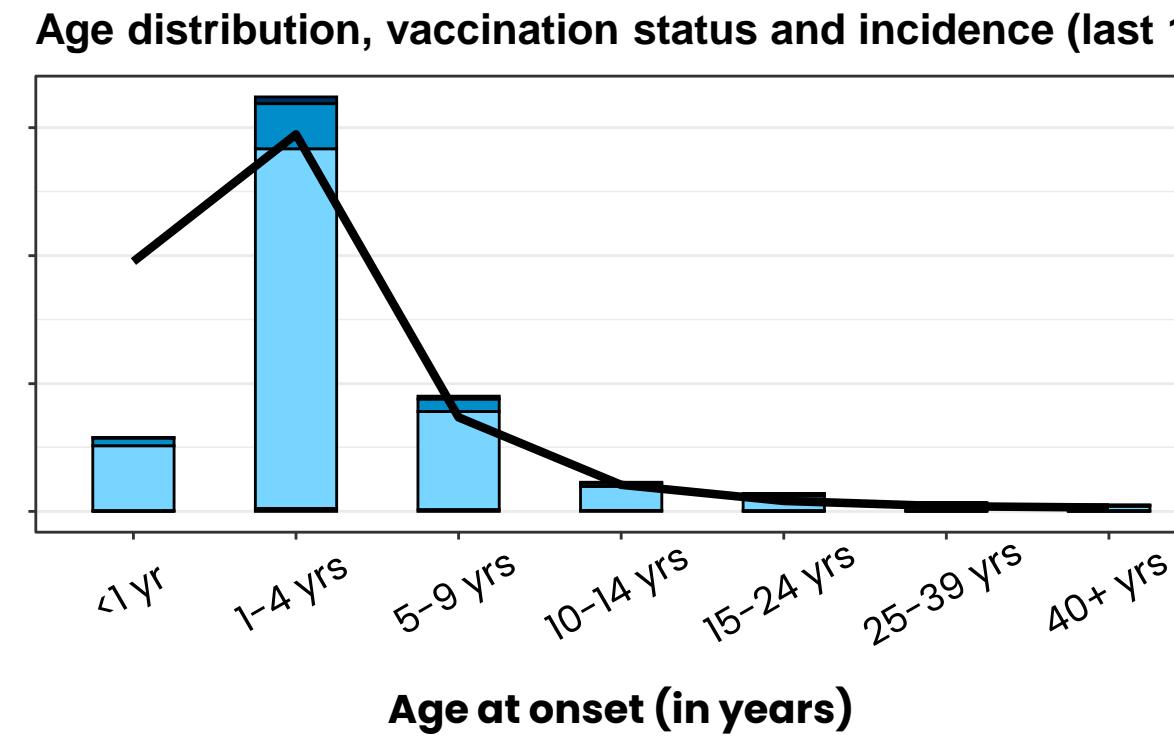
**2023**

**2024**

Number of measles cases

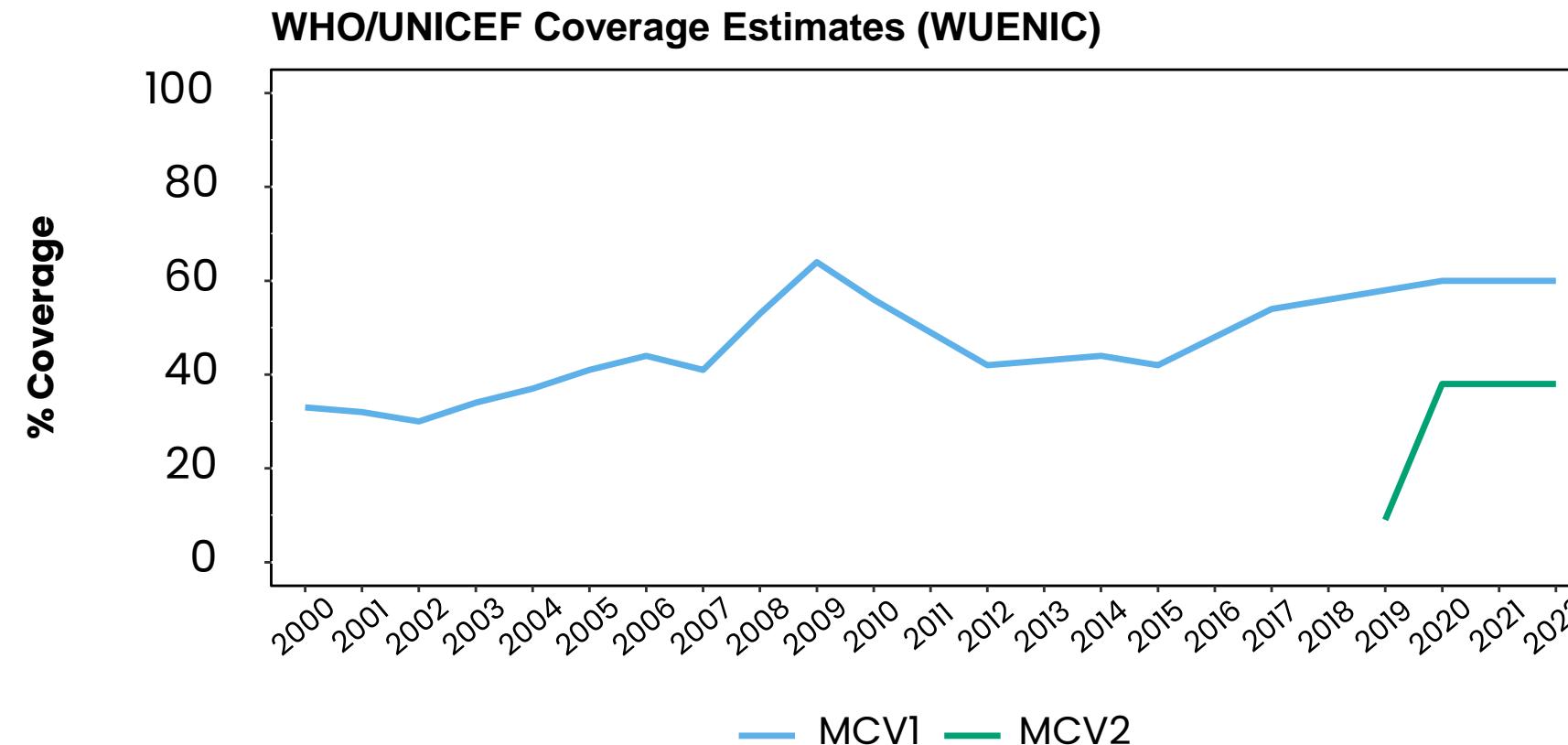


Number of cases



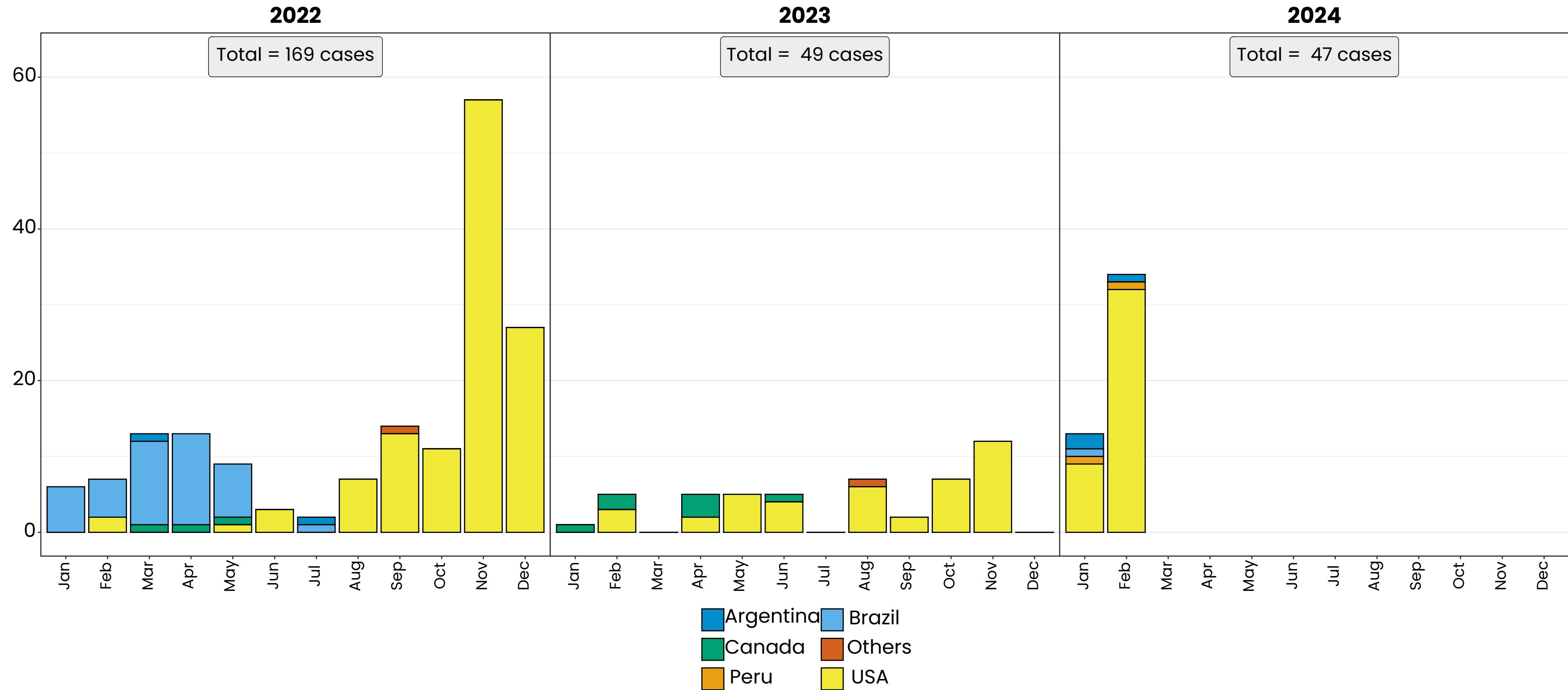
Incidence rate per M

% Coverage

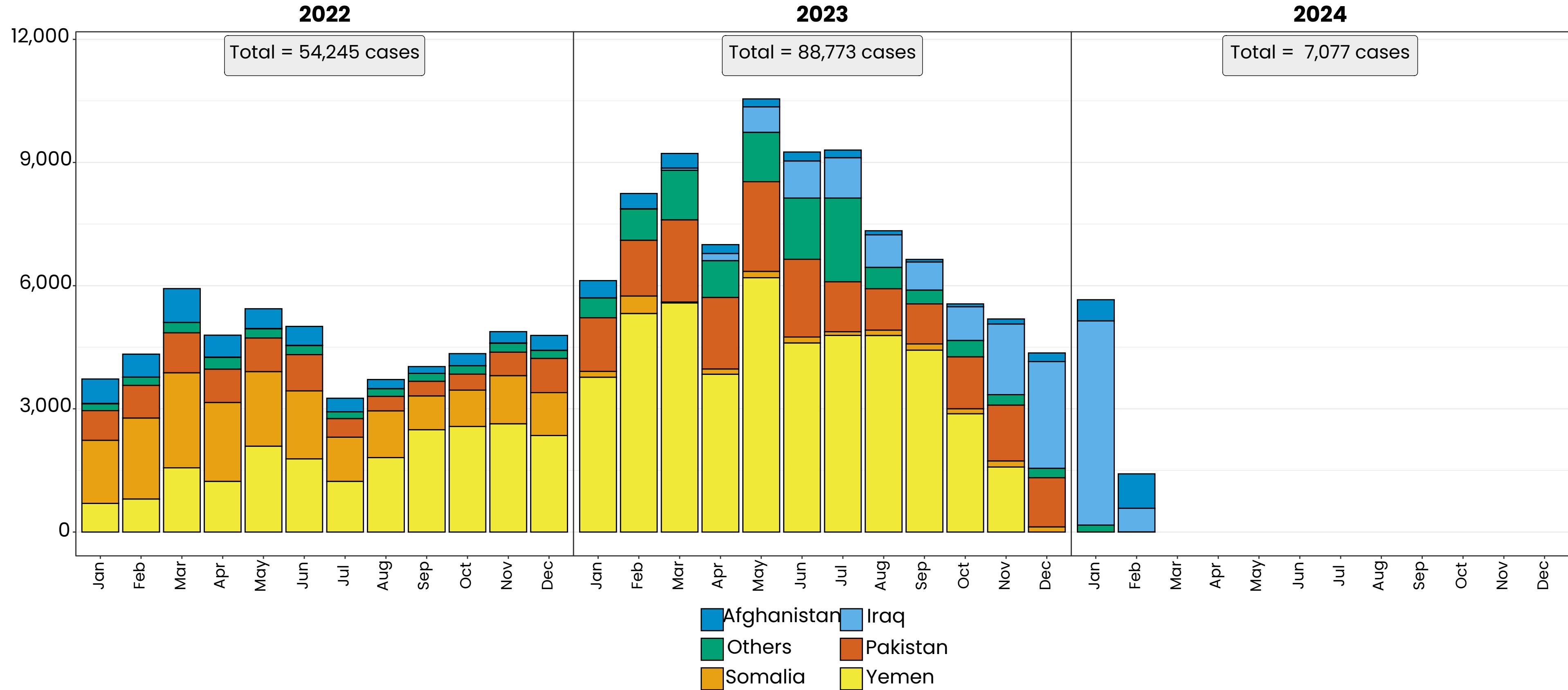


Based on data received 2024-03 - Data Source: IVB Database. Main epi curve was built using case-based surveillance data. Age distribution curve was built using case-based surveillance data. Coverage data from WHO/UNICEF Estimates of National Immunization Coverage (WUENIC)

# Measles case distribution (AMR), 2022-2024

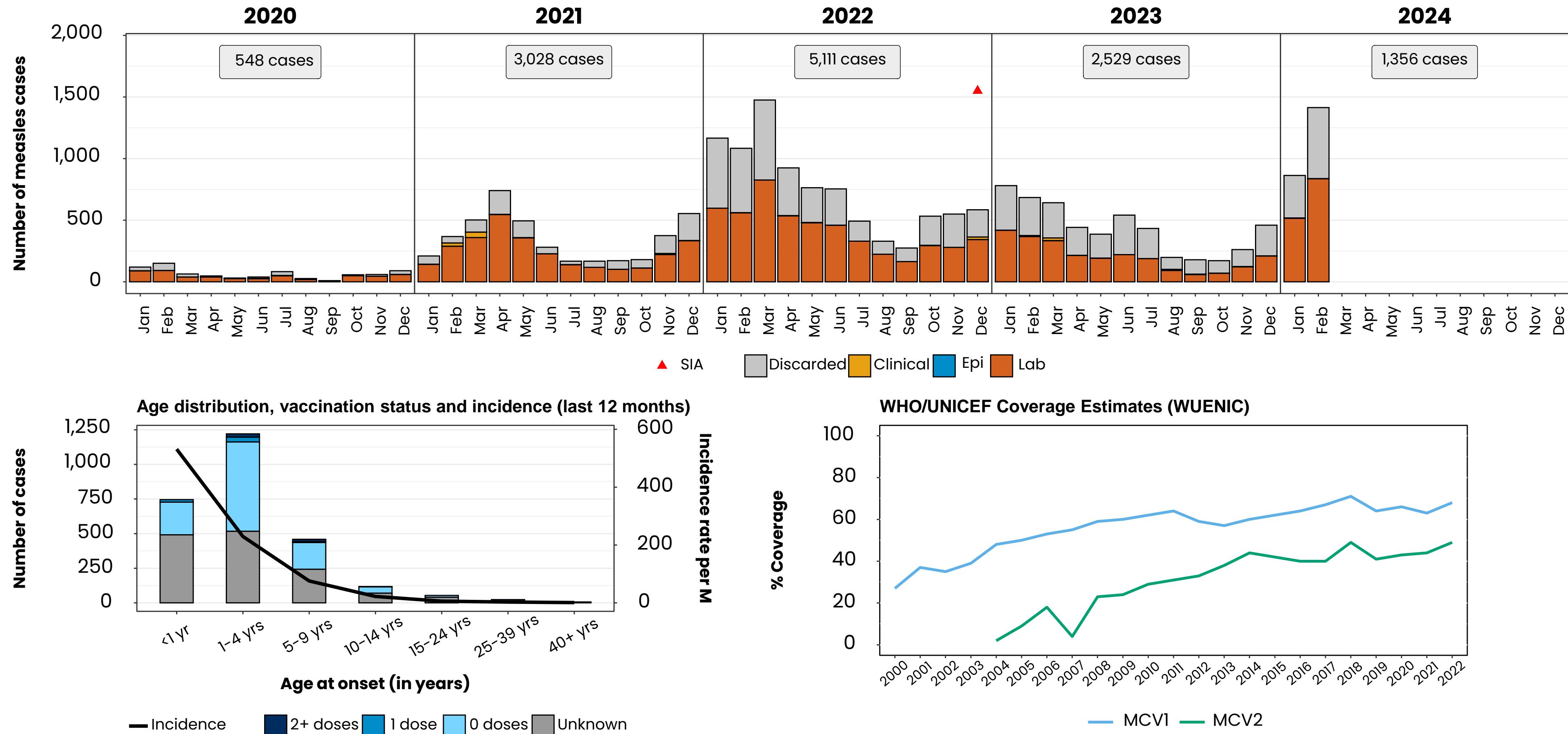


# Measles case distribution (EMR), 2022–2024



# Measles cases: Afghanistan

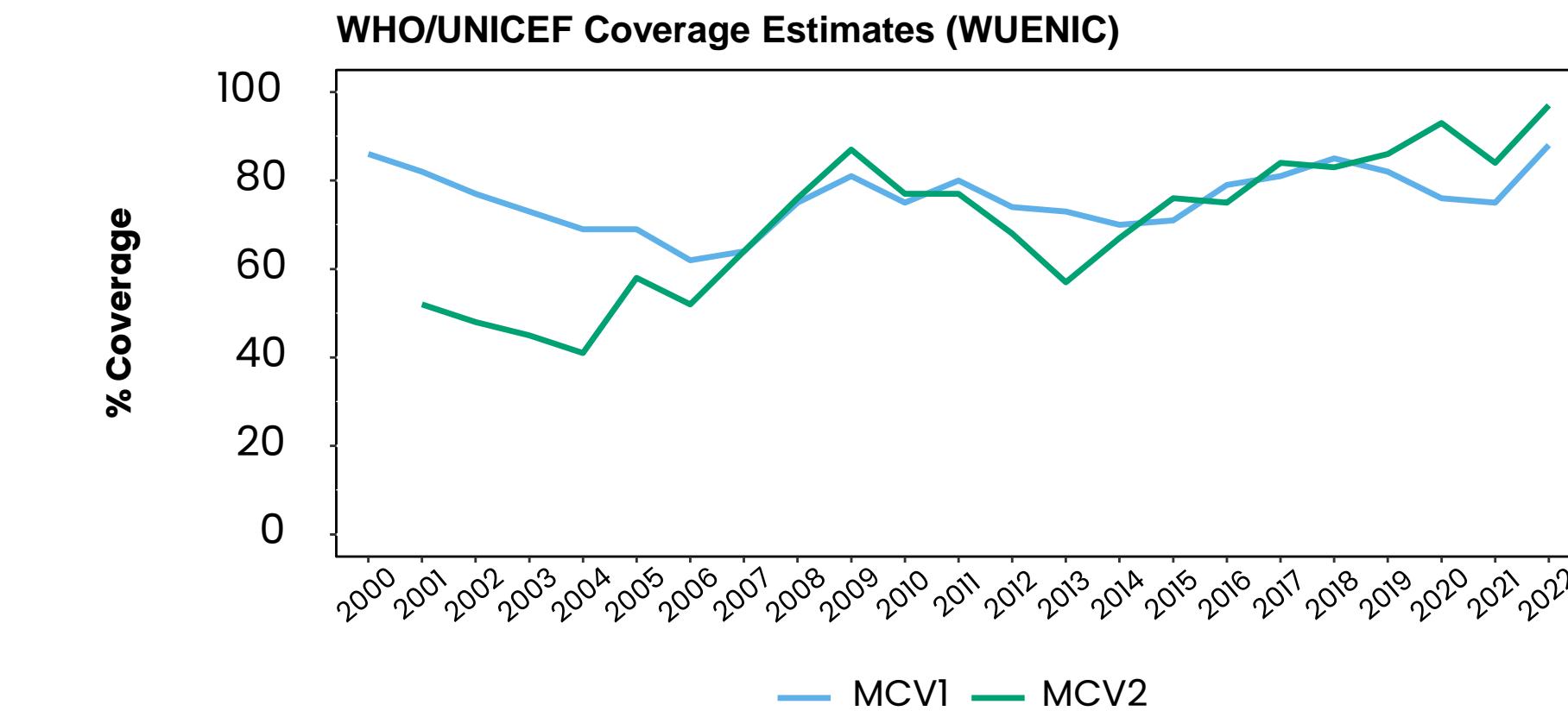
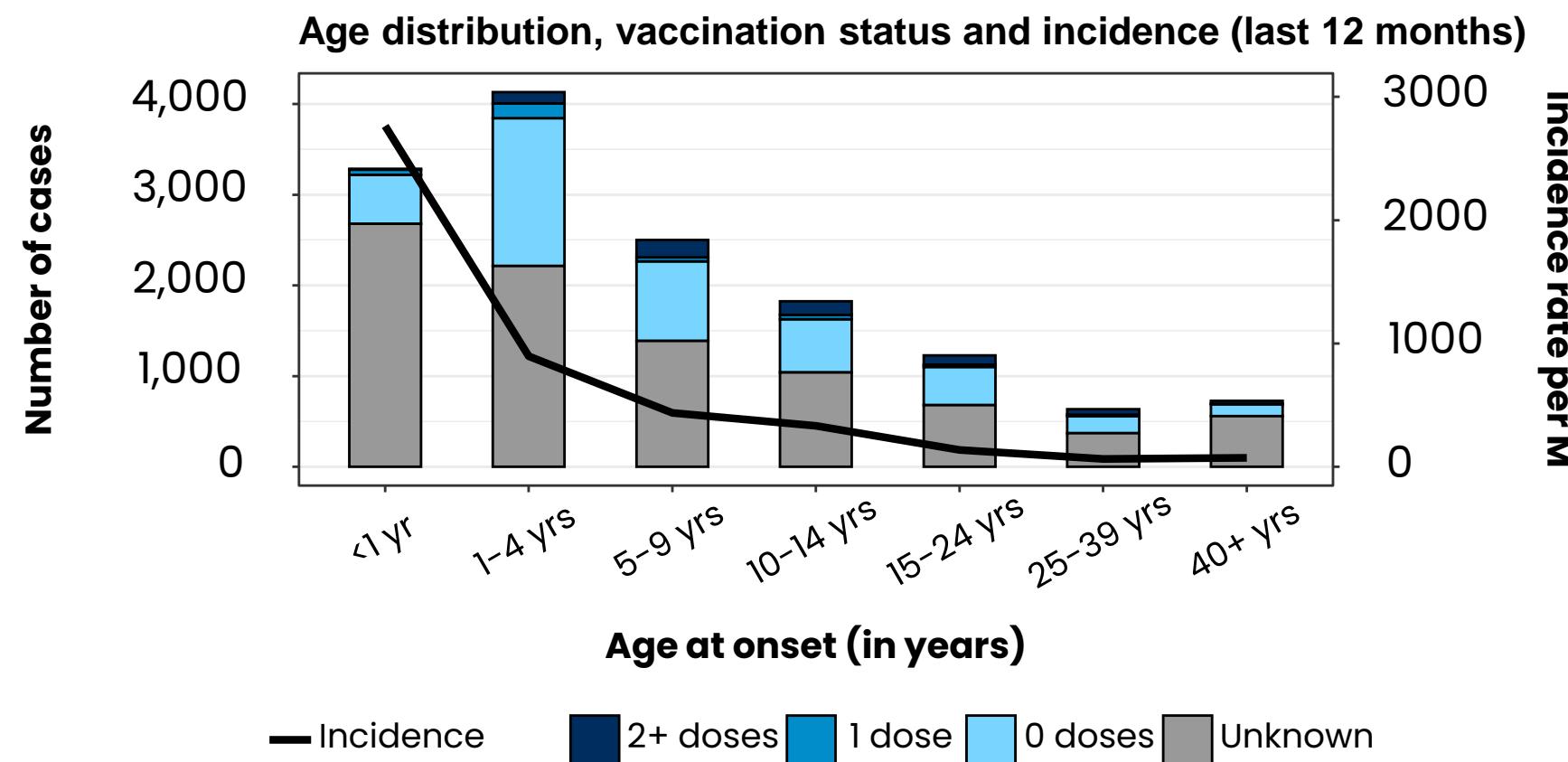
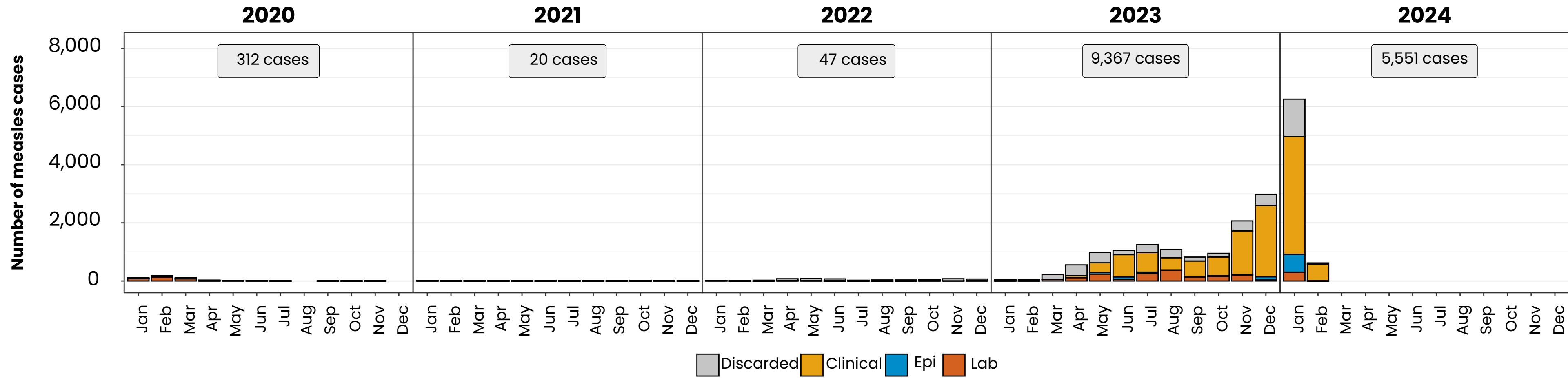
ELIMINATION STATUS: **ENDEMIC**



Based on data received 2024-03 - Data Source: IVB Database. Main epi curve was built using case-based surveillance data. Age distribution curve was built using case-based surveillance data. Coverage data from WHO/UNICEF Estimates of National Immunization Coverage (WUENIC)

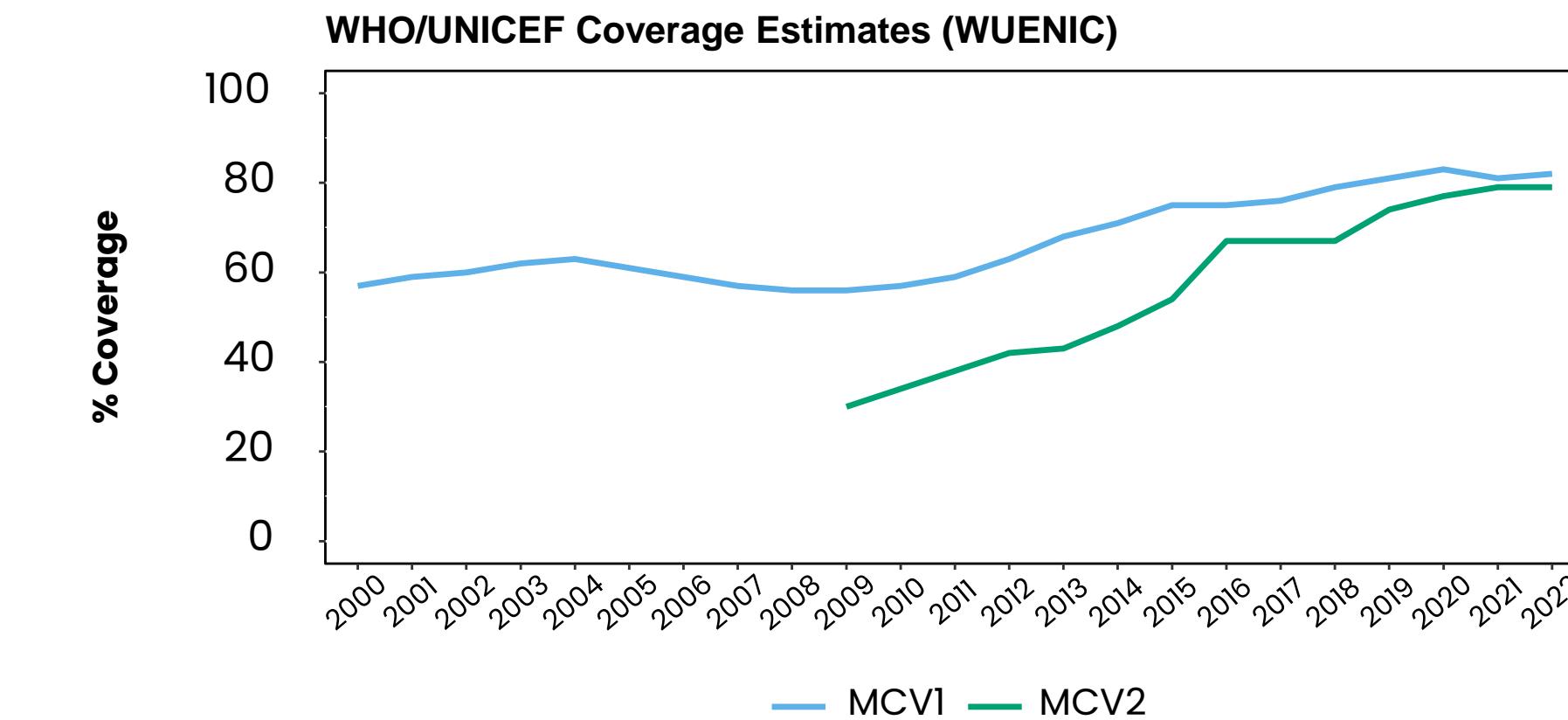
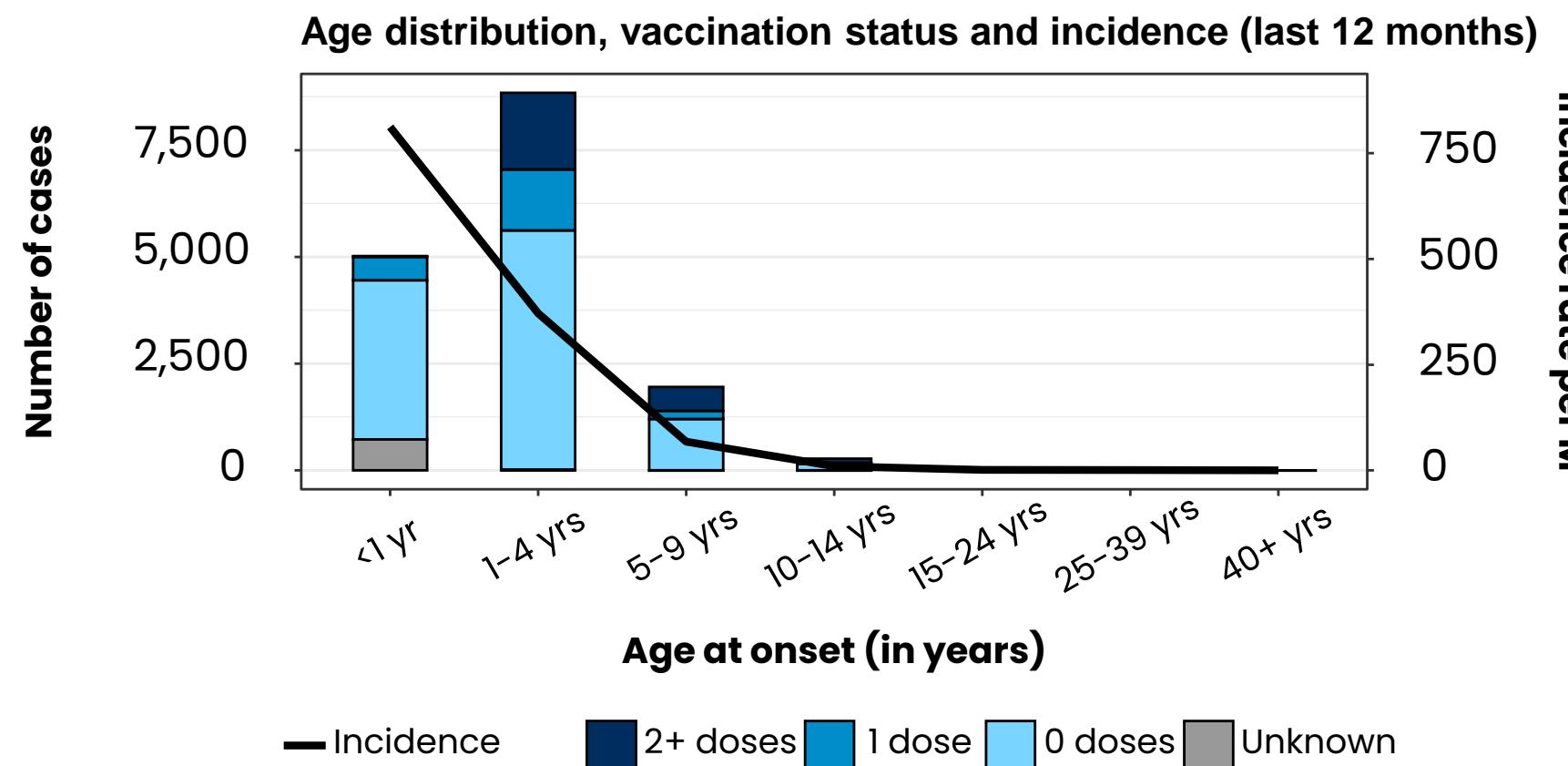
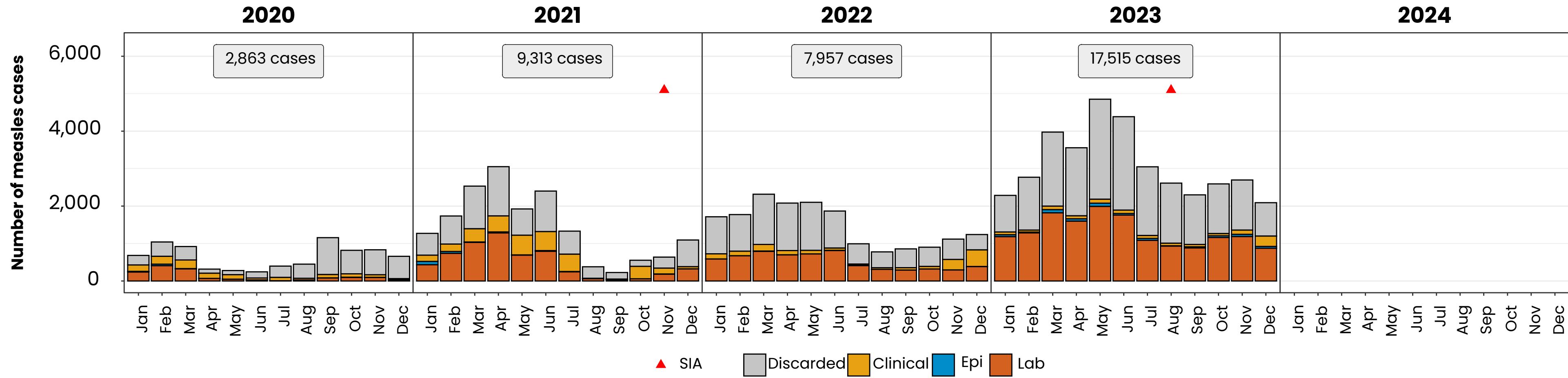
# Measles cases: Iraq

ELIMINATION STATUS: **ENDEMIC**



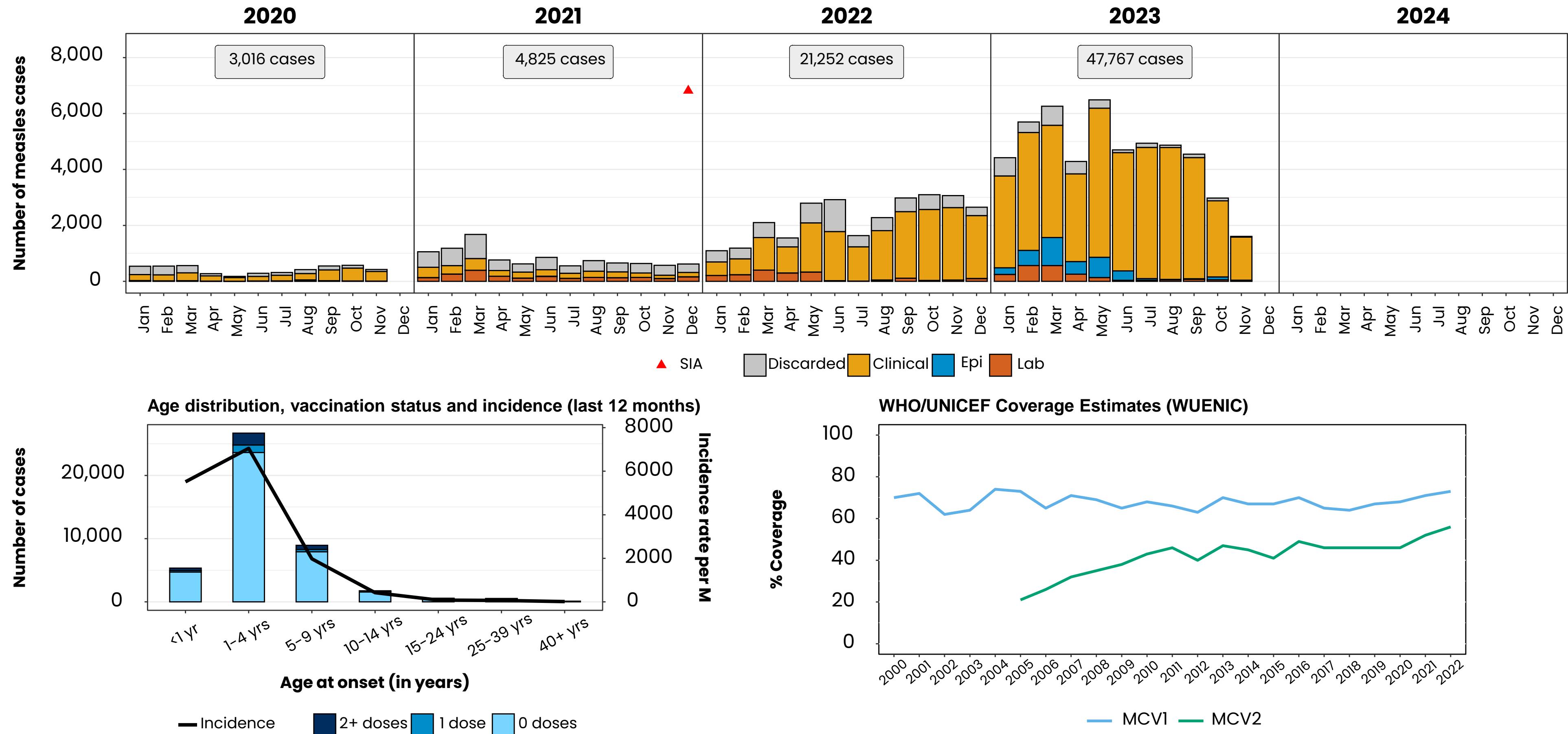
# Measles cases: Pakistan

ELIMINATION STATUS: **ENDEMIC**



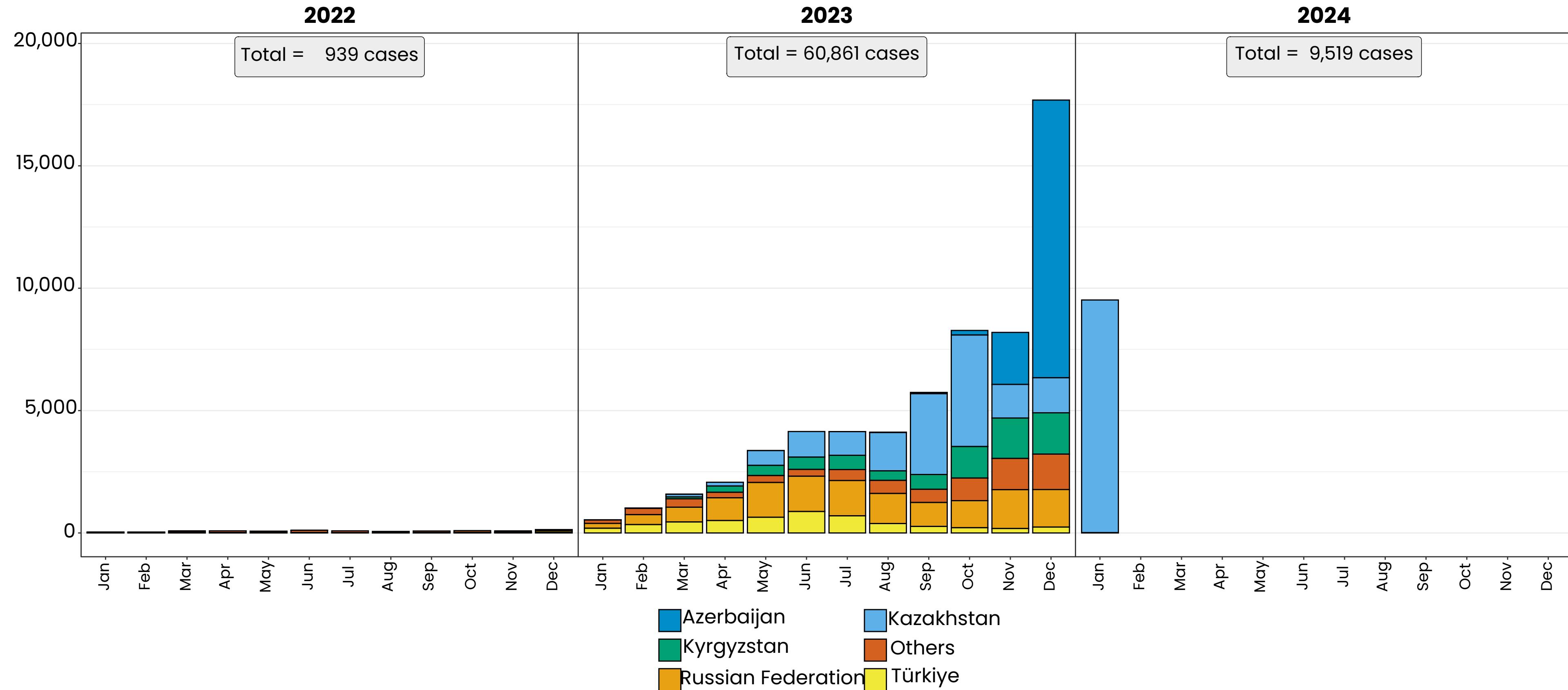
# Measles cases: Yemen

ELIMINATION STATUS: **ENDEMIC**



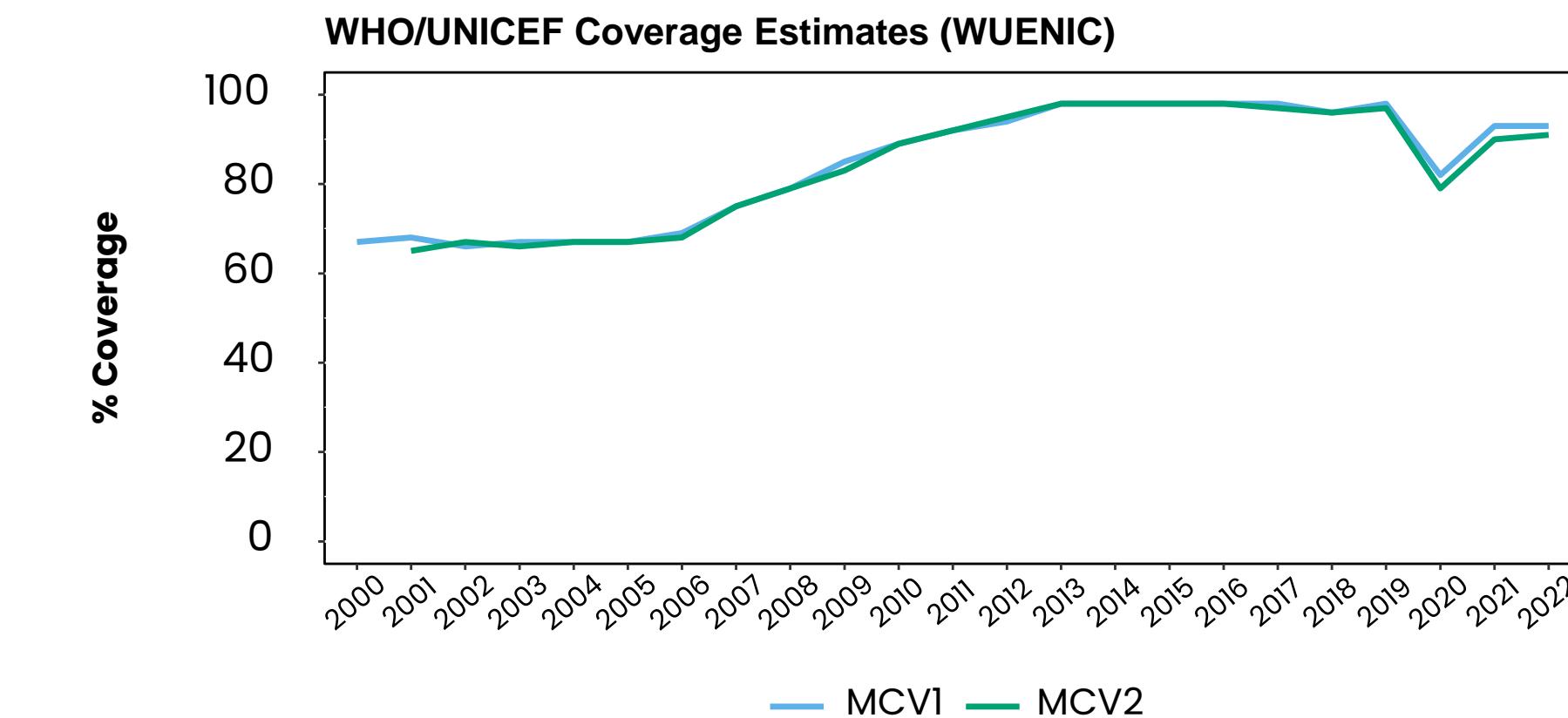
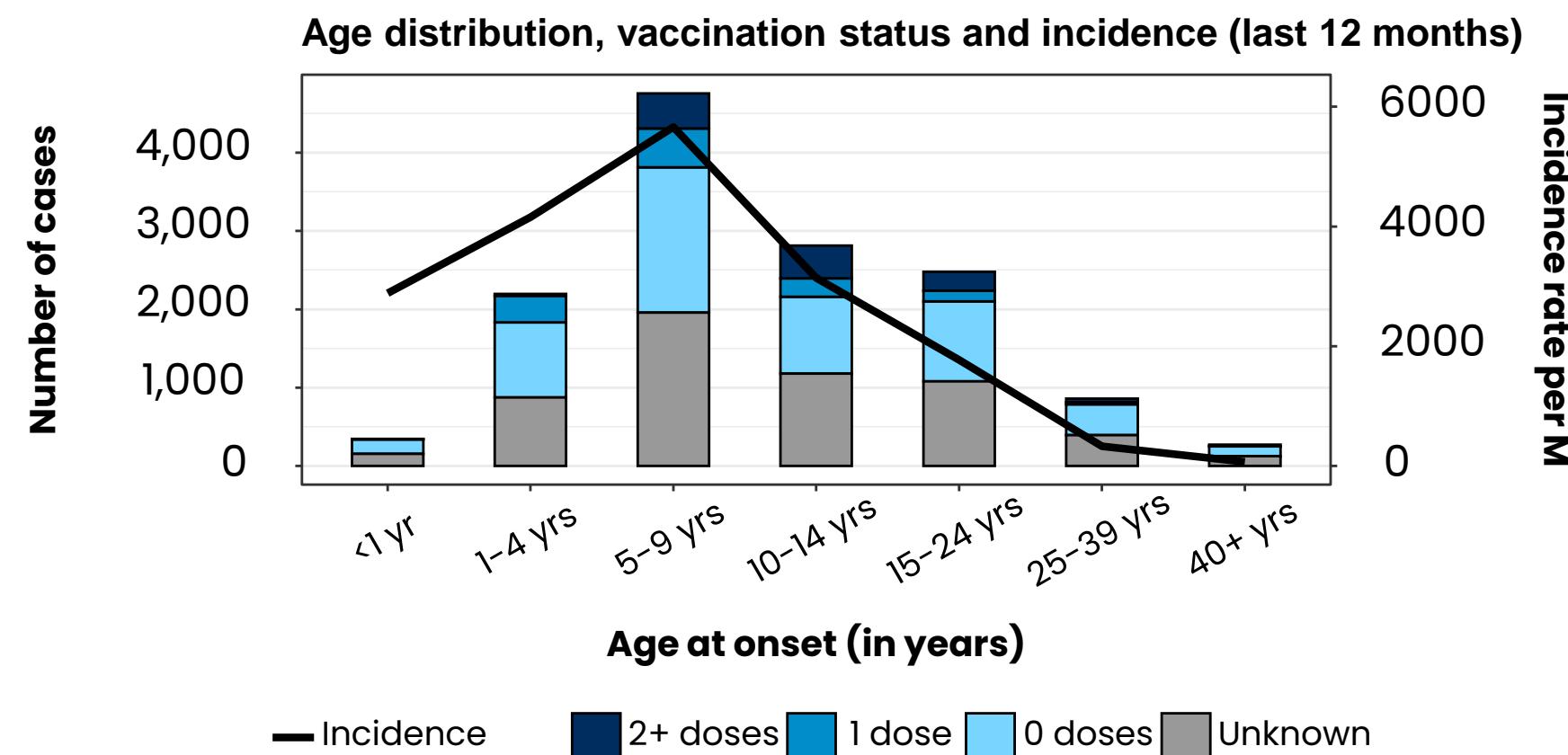
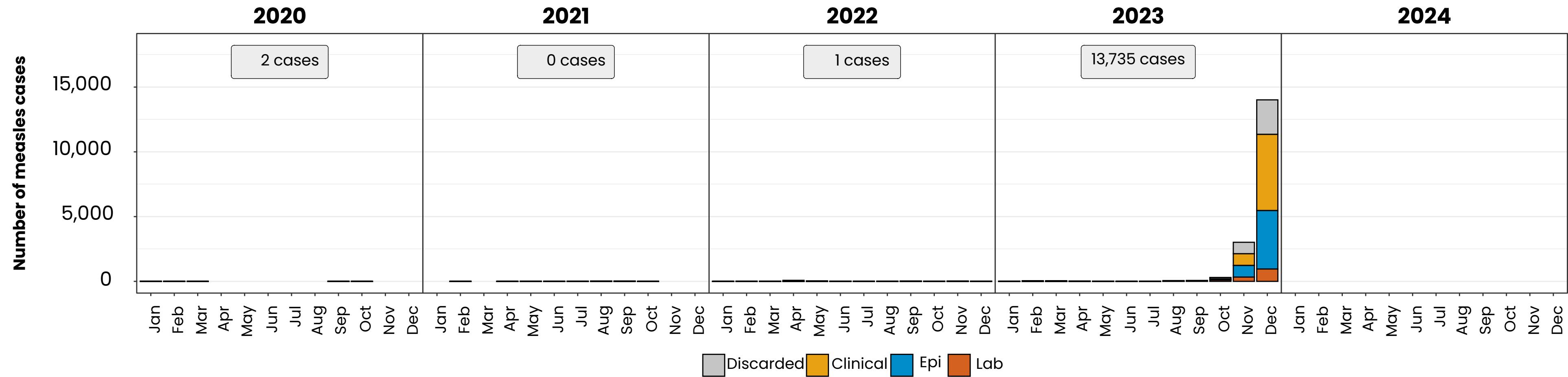
Based on data received 2024-03 - Data Source: IVB Database. Main epi curve was built using case-based surveillance data. Age distribution curve was built using case-based surveillance data. Coverage data from WHO/UNICEF Estimates of National Immunization Coverage (WUENIC)

# Measles case distribution (EUR), 2022–2024



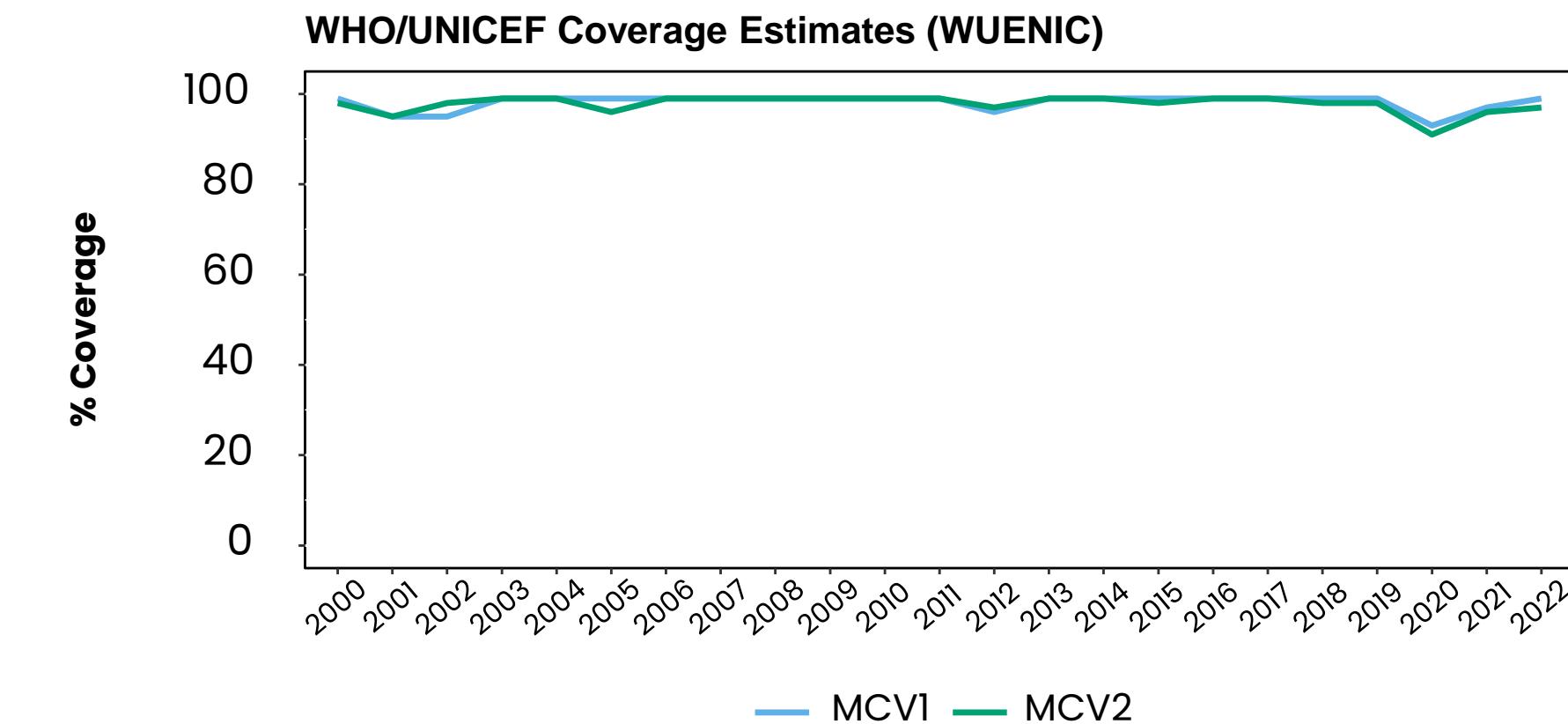
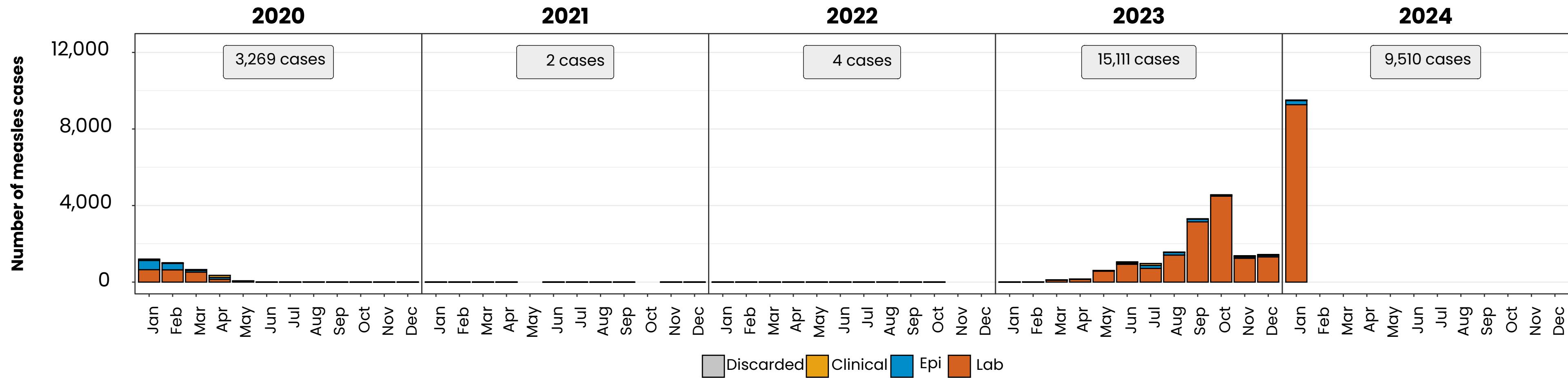
# Measles cases: Azerbaijan

ELIMINATION STATUS: **VERIFIED**



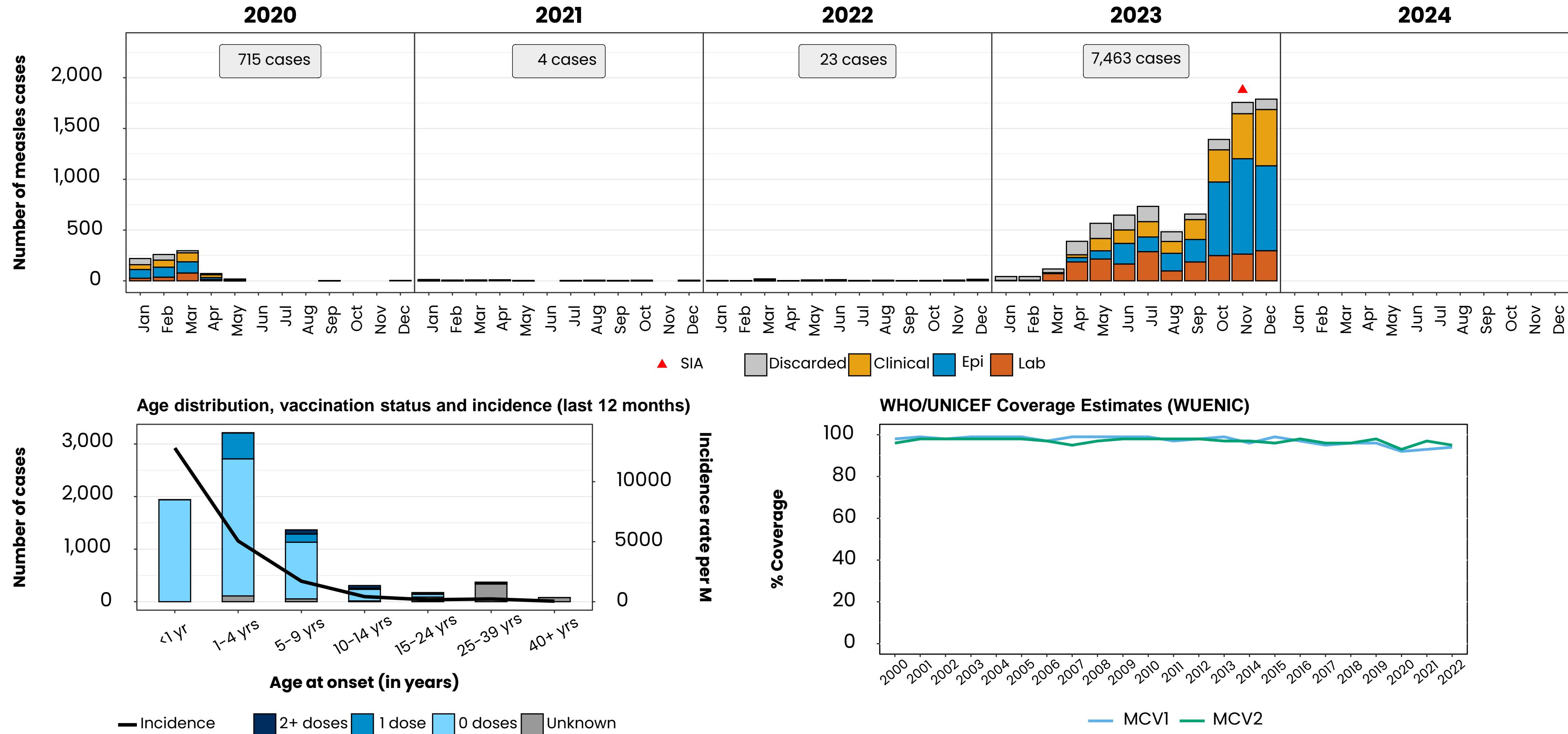
# Measles cases: Kazakhstan

ELIMINATION STATUS: **ENDEMIC**



# Measles cases: Kyrgyzstan

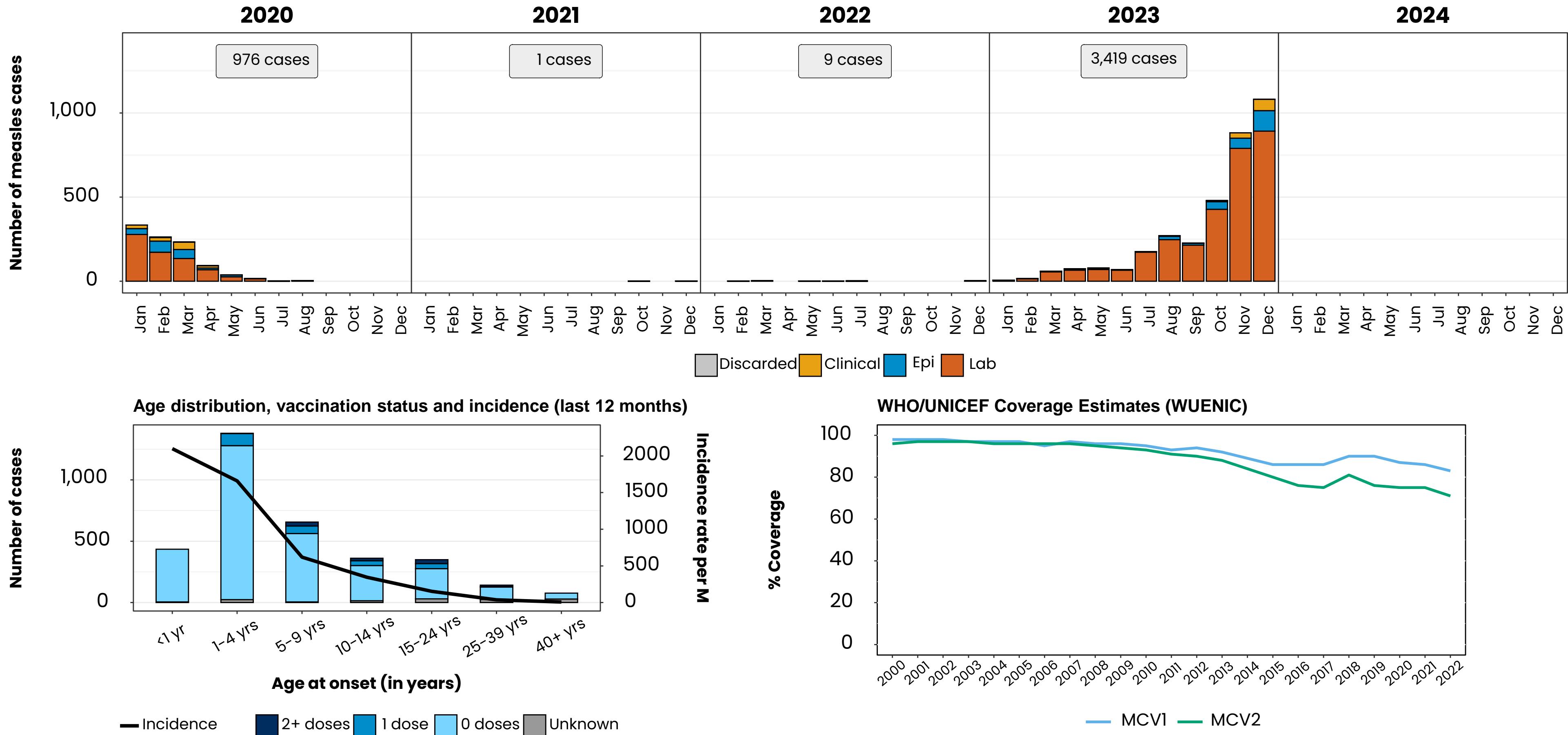
ELIMINATION STATUS: **ENDEMIC**



Based on data received 2024-03 - Data Source: IVB Database. Main epi curve was built using case-based surveillance data. Age distribution curve was built using case-based surveillance data. Coverage data from WHO/UNICEF Estimates of National Immunization Coverage (WUENIC)

# Measles cases: Romania

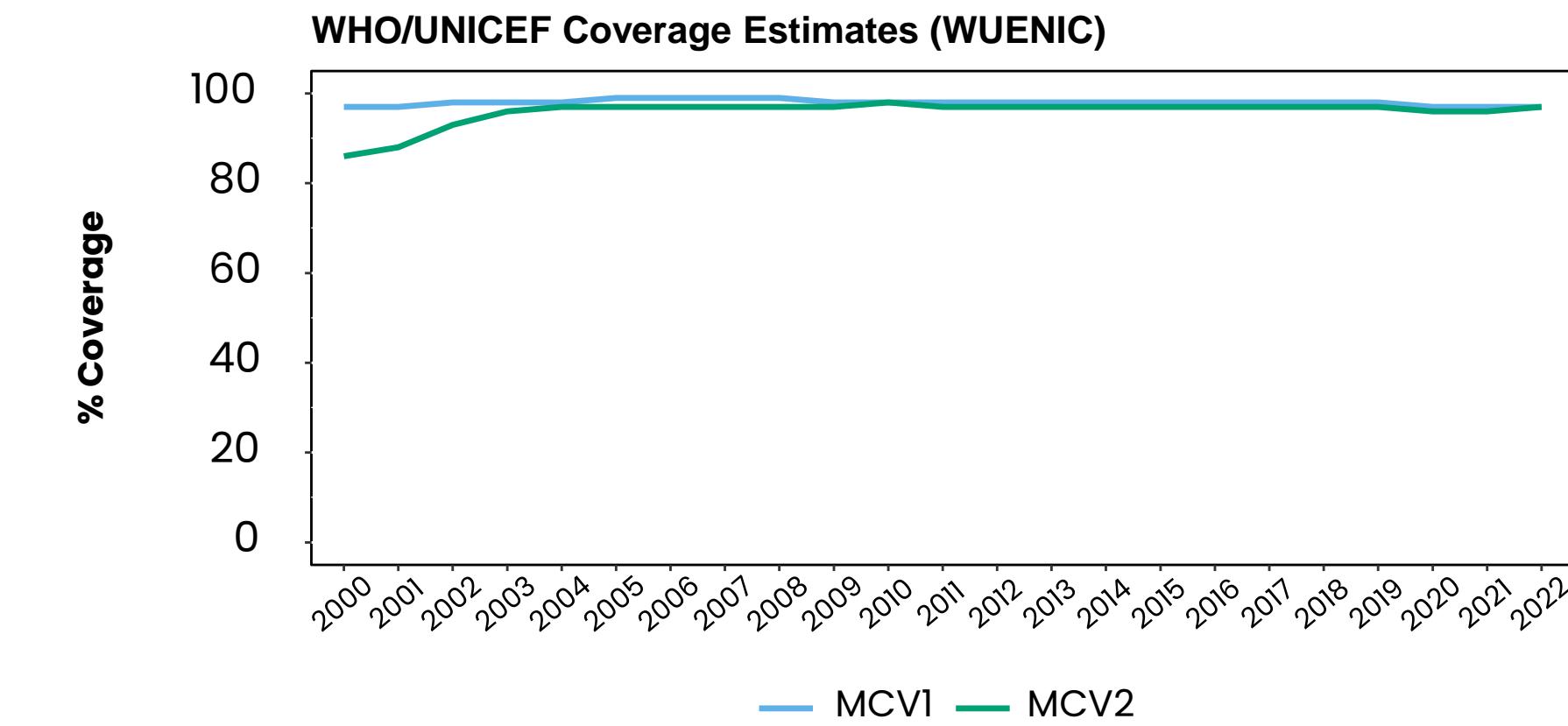
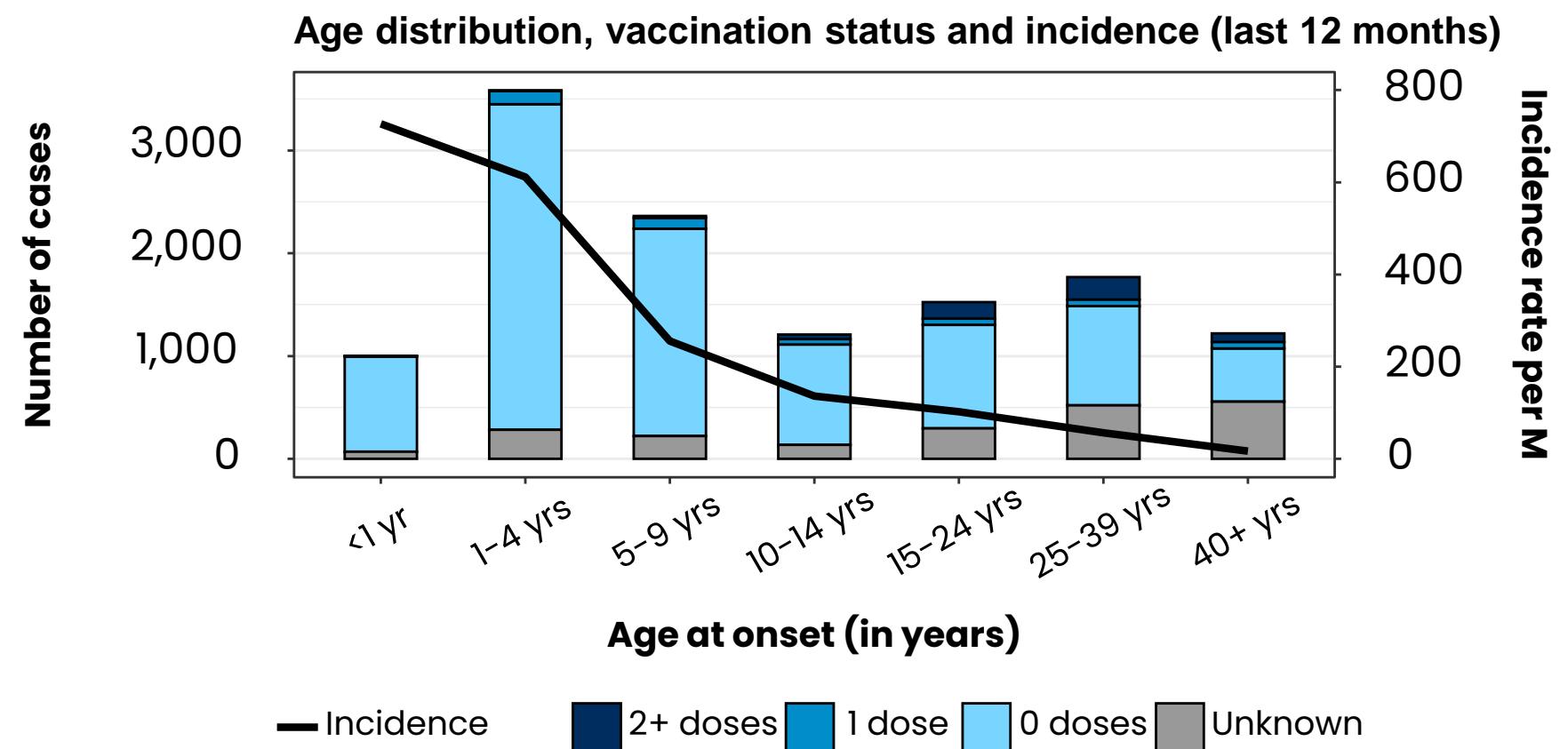
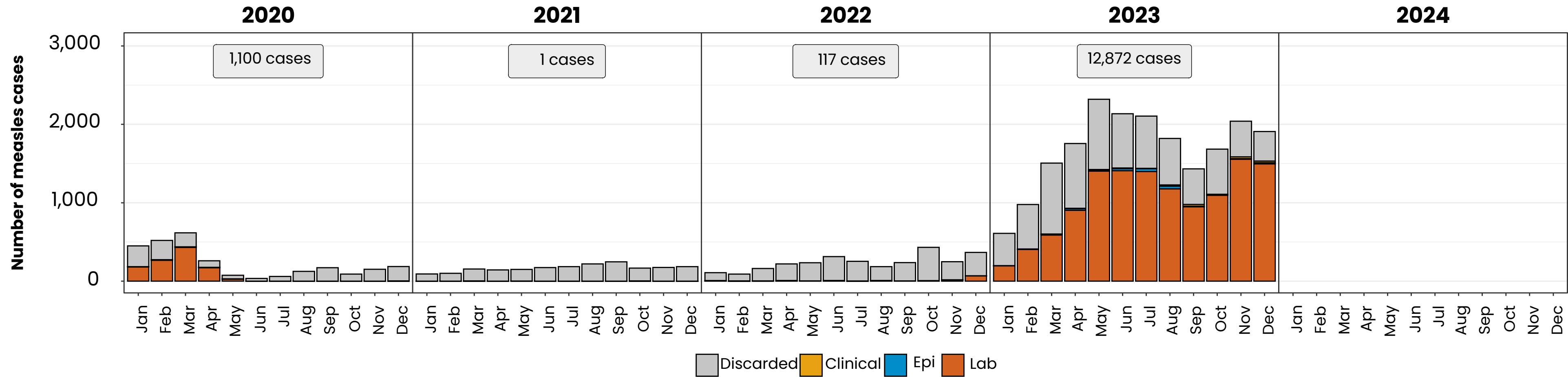
ELIMINATION STATUS: **ENDEMIC**



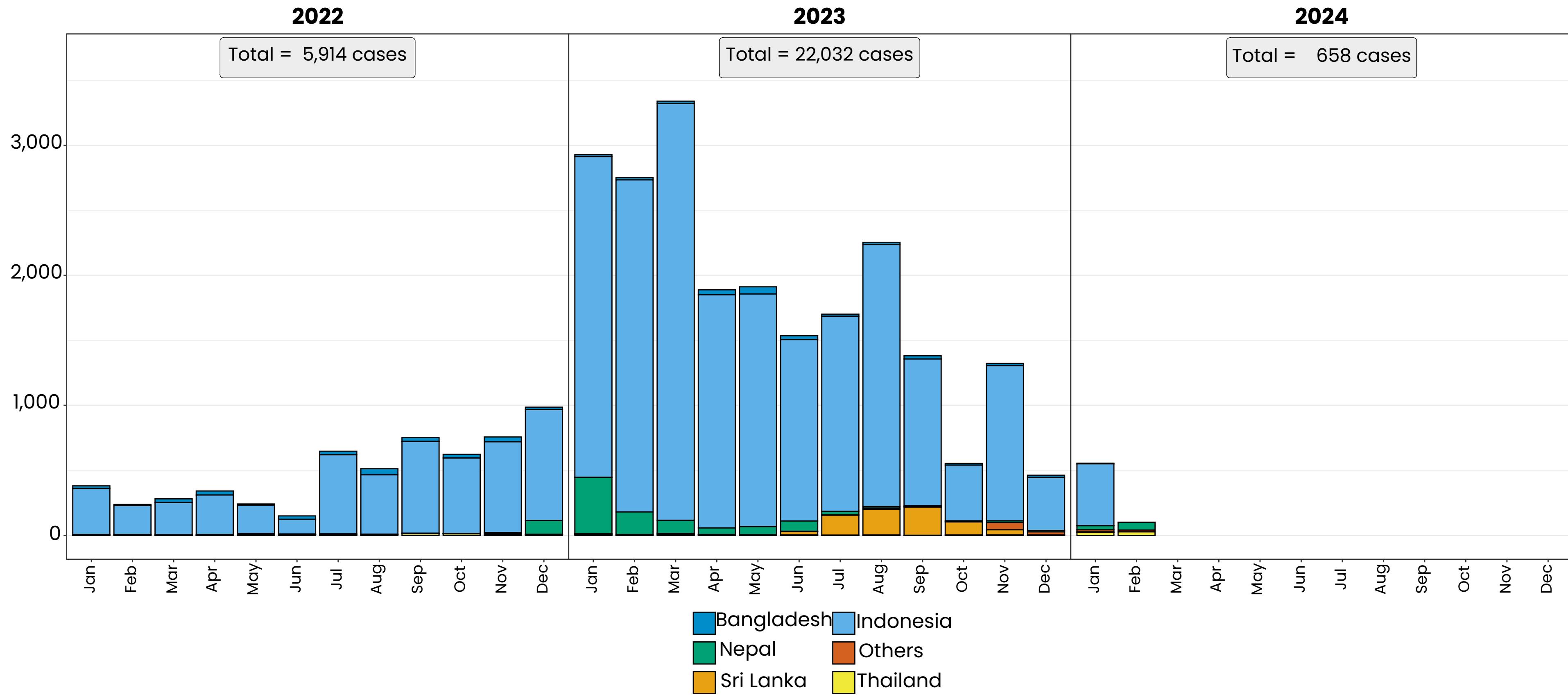
Based on data received 2024-03 - Data Source: IVB Database. Main epi curve was built using case-based surveillance data. Age distribution curve was built using case-based surveillance data. Coverage data from WHO/UNICEF Estimates of National Immunization Coverage (WUENIC)

# Measles cases: Russian Federation

ELIMINATION STATUS: **ELIMINATED**

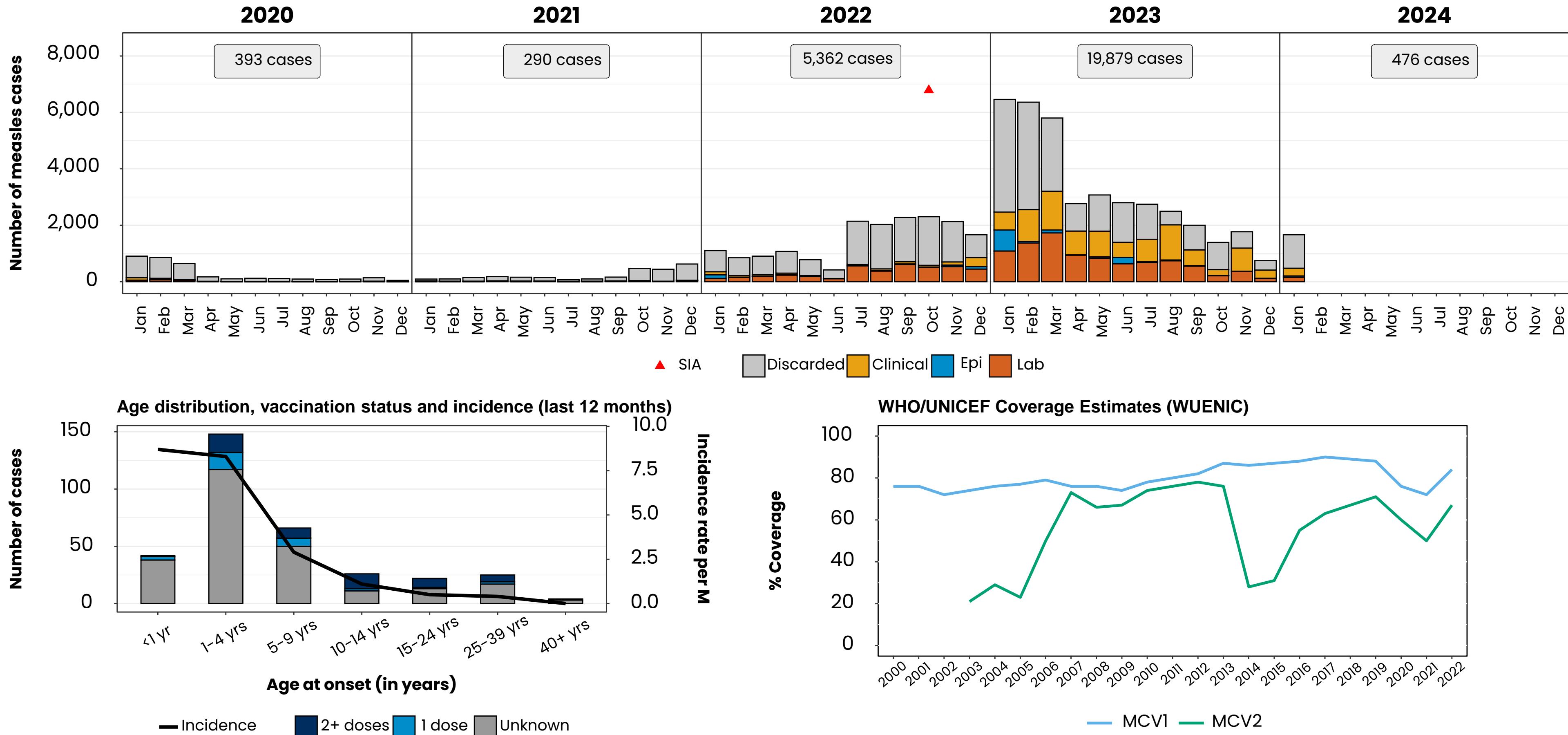


# Measles case distribution (SEAR (excl. India)), 2022–2024



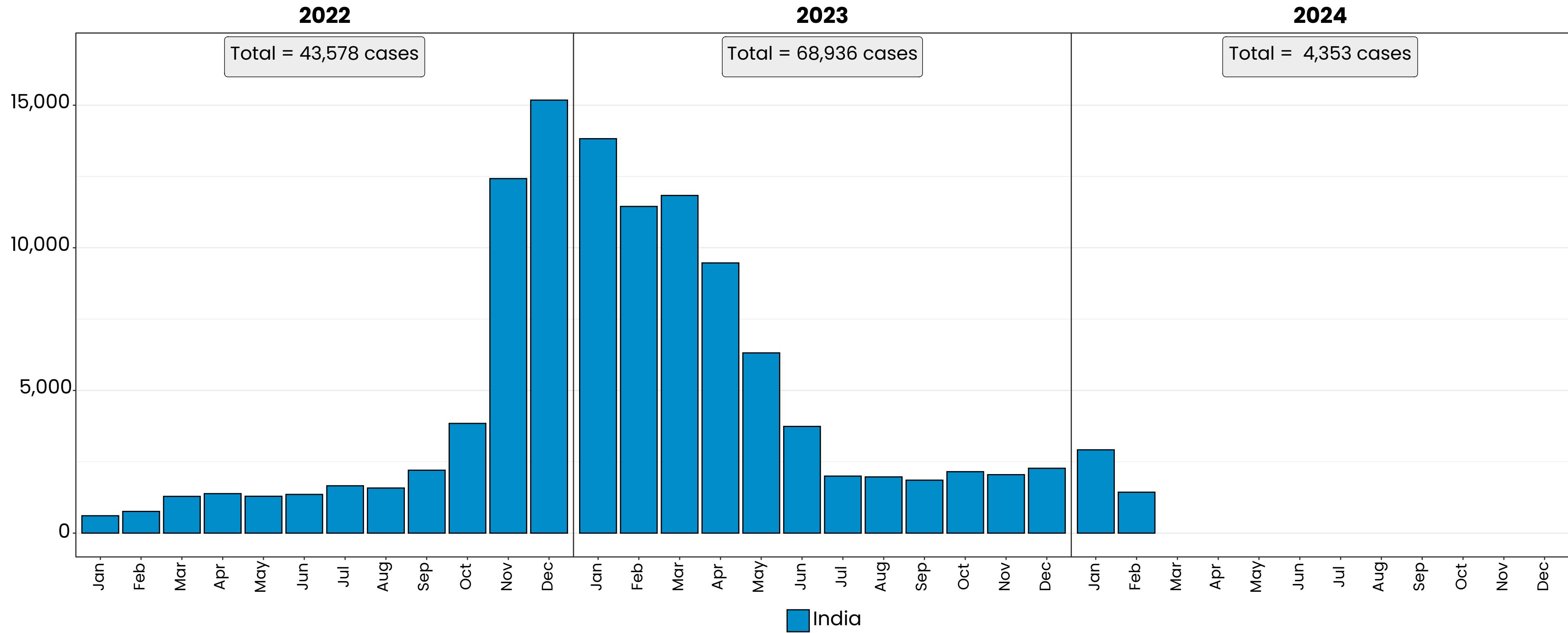
# Measles cases: Indonesia

ELIMINATION STATUS: **ENDEMIC**



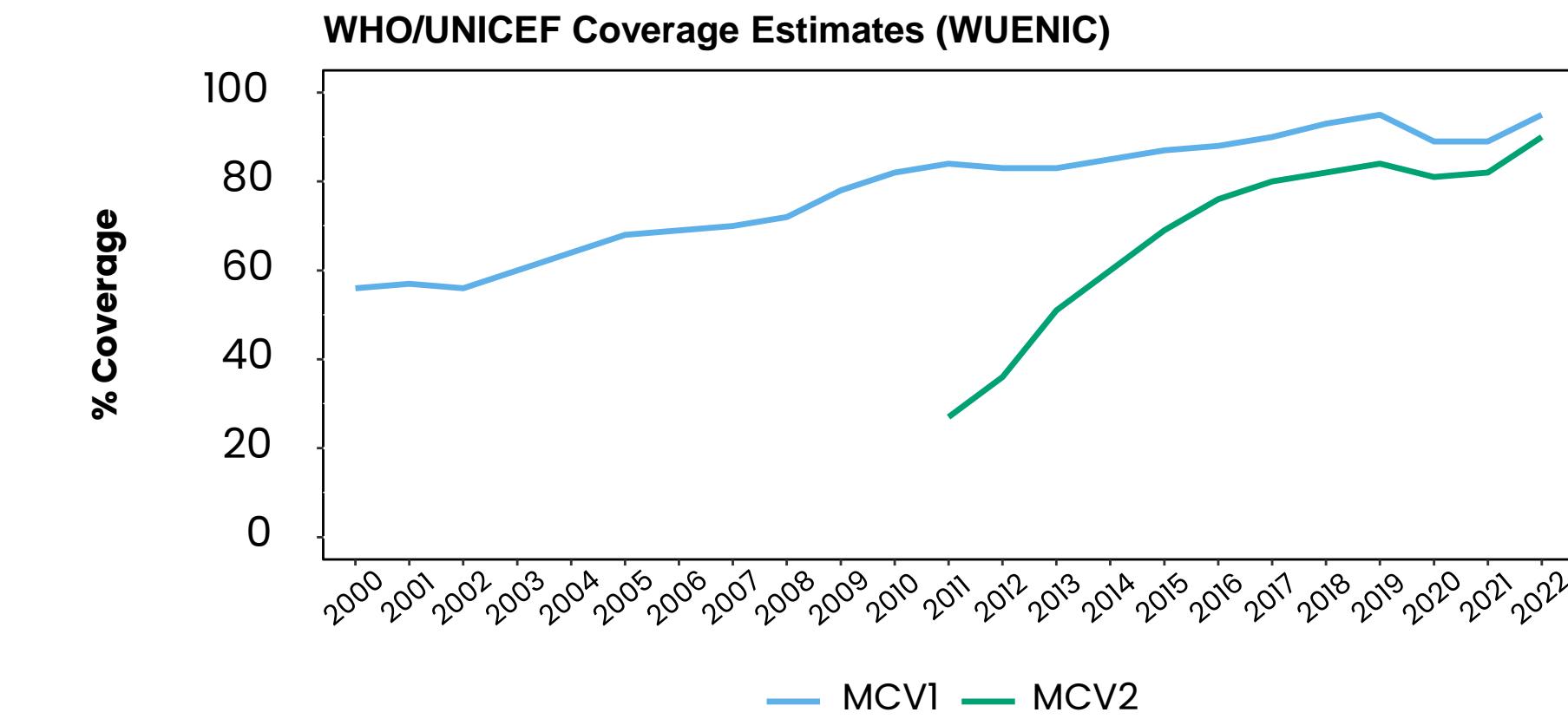
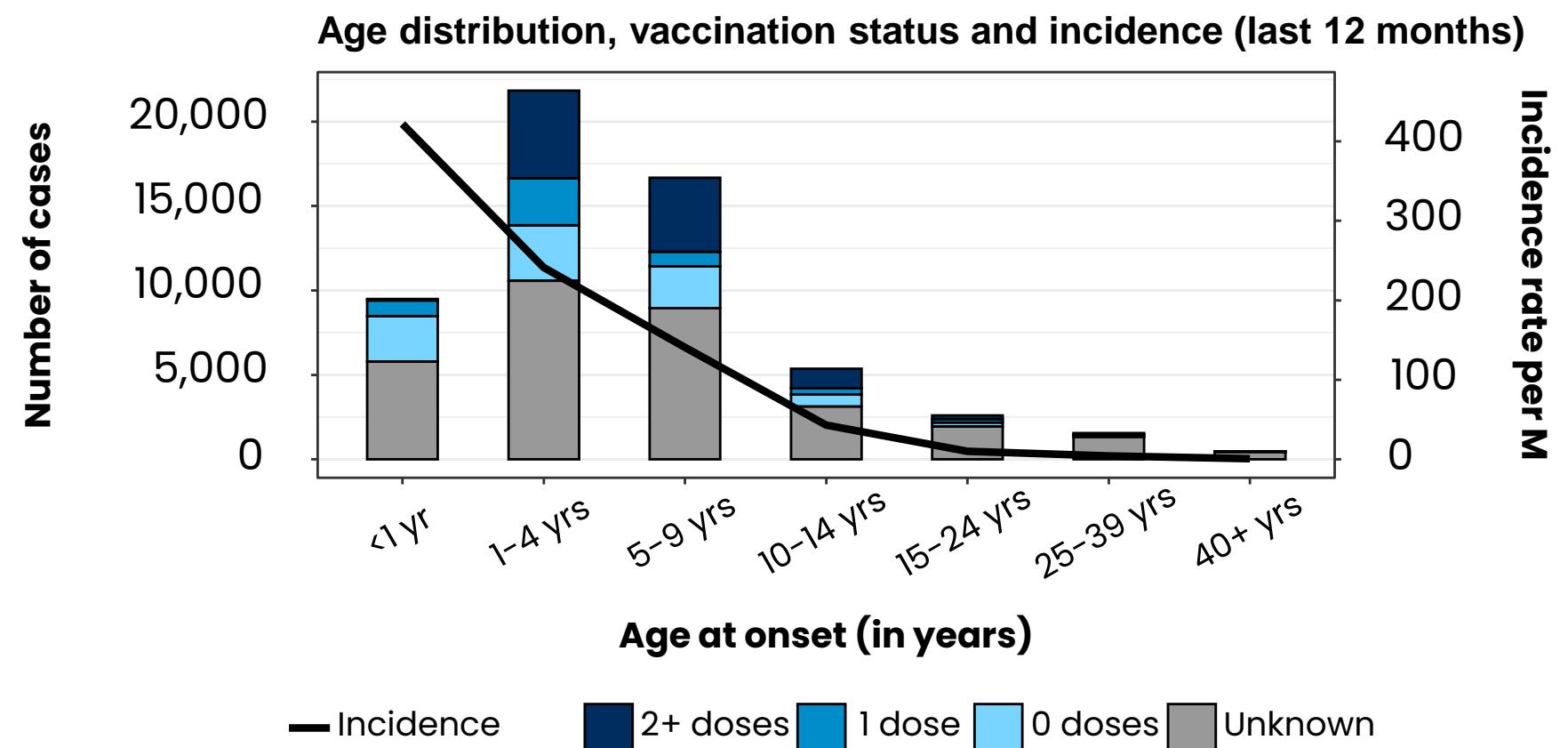
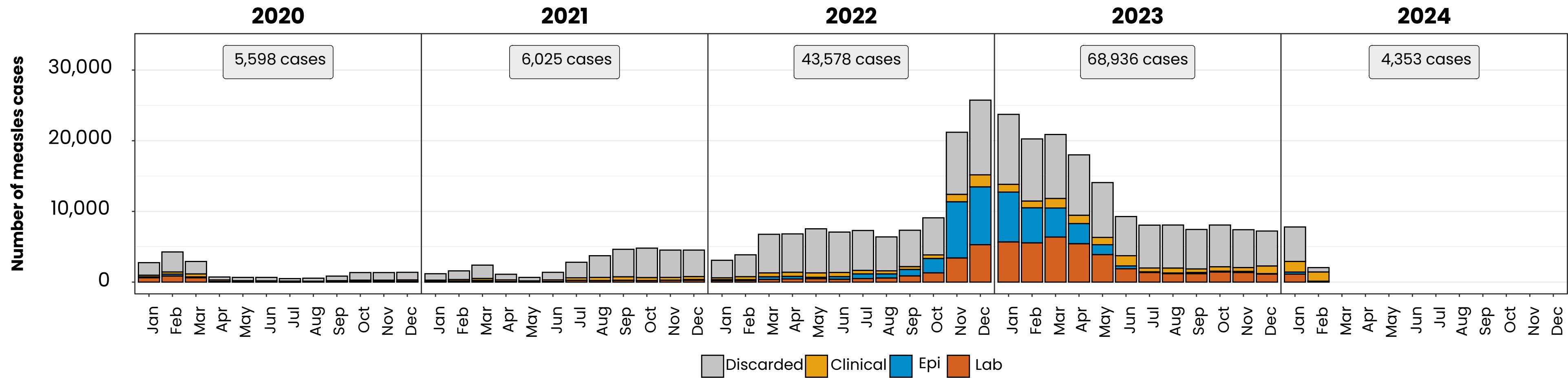
Based on data received 2024-03 - Data Source: IVB Database. Main epi curve was built using aggregate surveillance data. Age distribution curve was built using case-based surveillance data. Coverage data from WHO/UNICEF Estimates of National Immunization Coverage (WUENIC)

# Measles case distribution (SEAR, India), 2022-2024



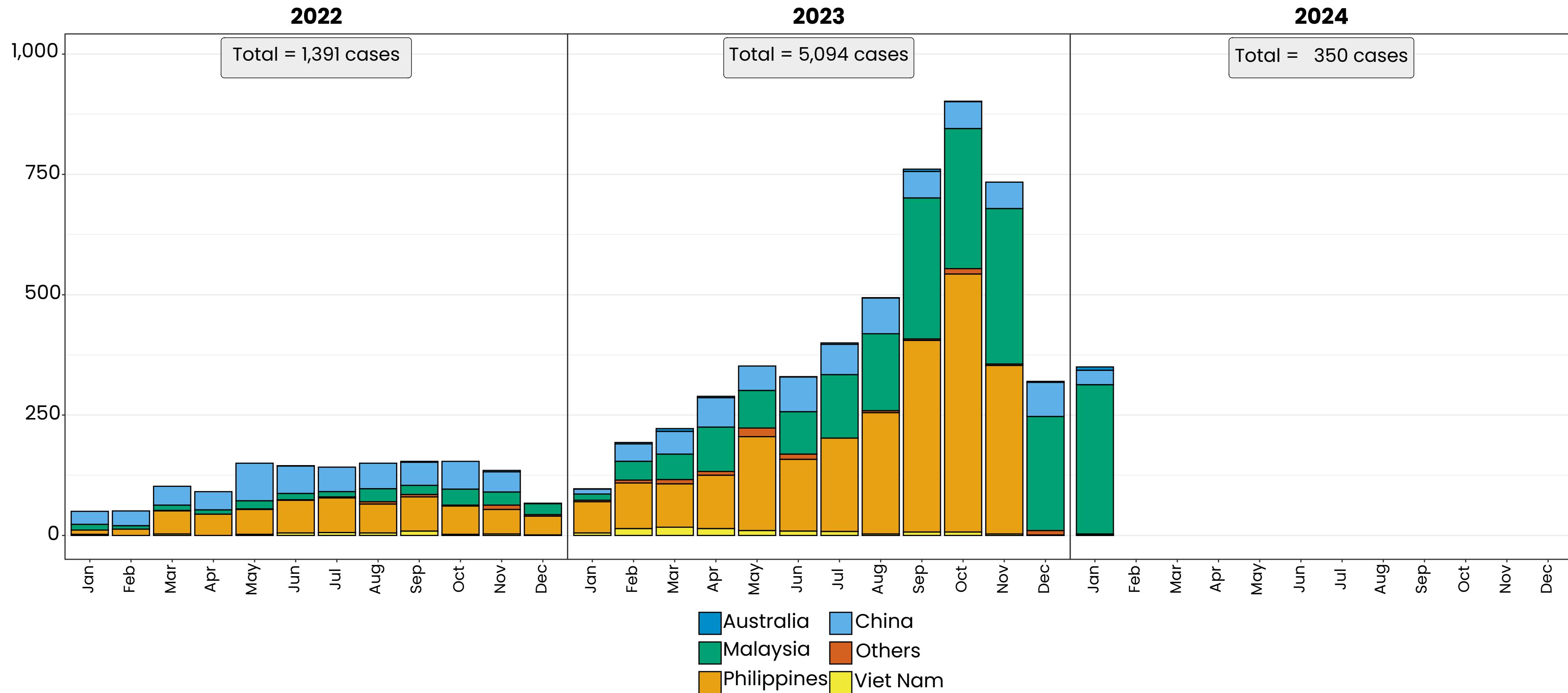
# Measles cases: India

ELIMINATION STATUS: **ENDEMIC**

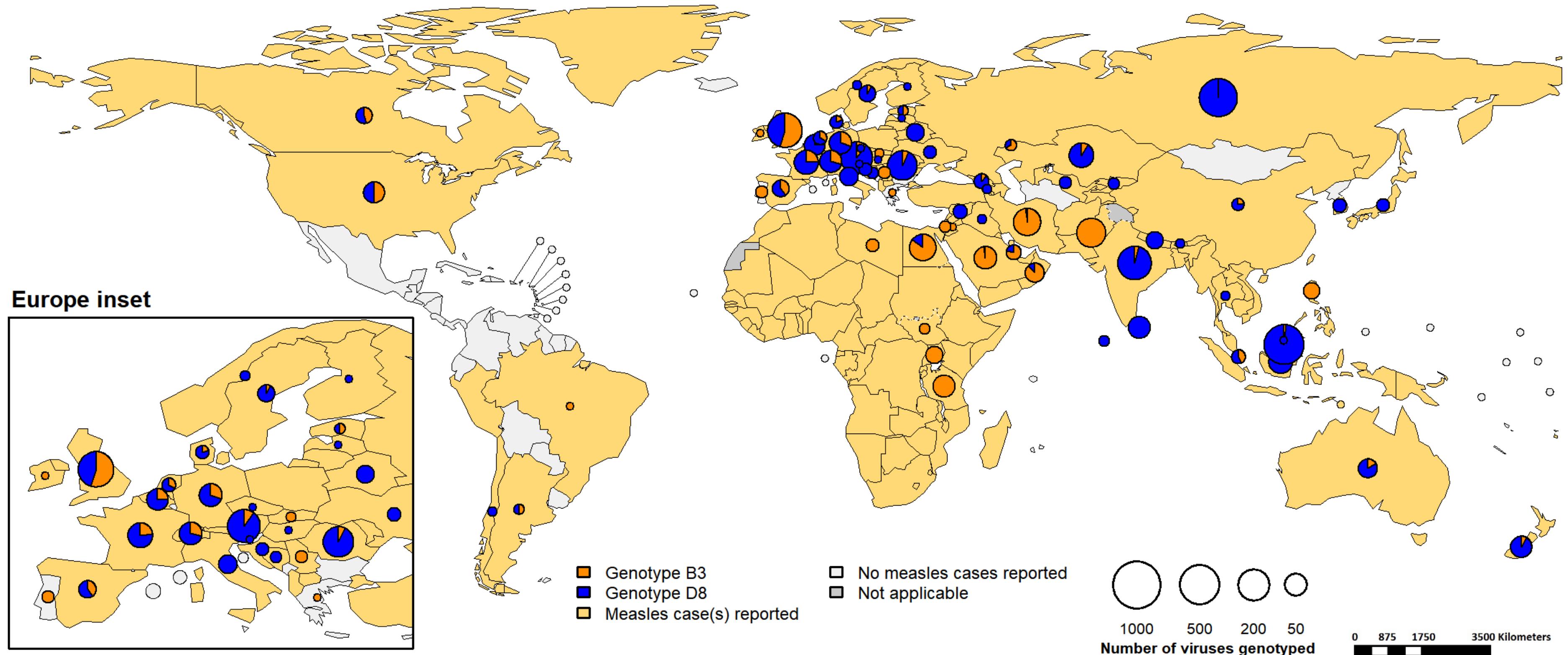


Based on data received 2024-03 - Data Source: IVB Database. Main epi curve was built using a combination of case-based and aggregate surveillance data. Age distribution curve was built using case-based surveillance data. Coverage data from WHO/UNICEF Estimates of National Immunization Coverage (WUENIC)

# Measles case distribution (WPR), 2022-2024



# Distribution of measles genotypes (last 12 months)



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Data source: IVB & MeaNS Databases

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**Rubella**



**World Health  
Organization**

**IVB**

# Number of reported rubella cases by WHO Region

**2024**

Region	Member States*	Rubella cases	Clin	Epi	Lab	Date Received
AFR	34/47	1,235	0	0	1,235	2024-03
AMR	15/35	0	0	0	0	2024-03
EMR	13/21	47	0	0	47	2024-03
EUR	0/53	0	0	0	0	2024-03
SEAR	8/11	241	0	16	225	2024-03
WPR	10/27	34	10	0	24	2024-03
<b>Total</b>	<b>82/194</b>	<b>1,557</b>	<b>10</b>	<b>16</b>	<b>1,531</b>	

Region	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
AFR	919	316	0	0	0	0	0	0	0	0	0	0
AMR	0	0	0	0	0	0	0	0	0	0	0	0
EMR	25	22	0	0	0	0	0	0	0	0	0	0
EUR	0	0	0	0	0	0	0	0	0	0	0	0
SEAR	219	22	0	0	0	0	0	0	0	0	0	0
WPR	34	0	0	0	0	0	0	0	0	0	0	0
<b>Total</b>	<b>1,197</b>	<b>360</b>	<b>0</b>									

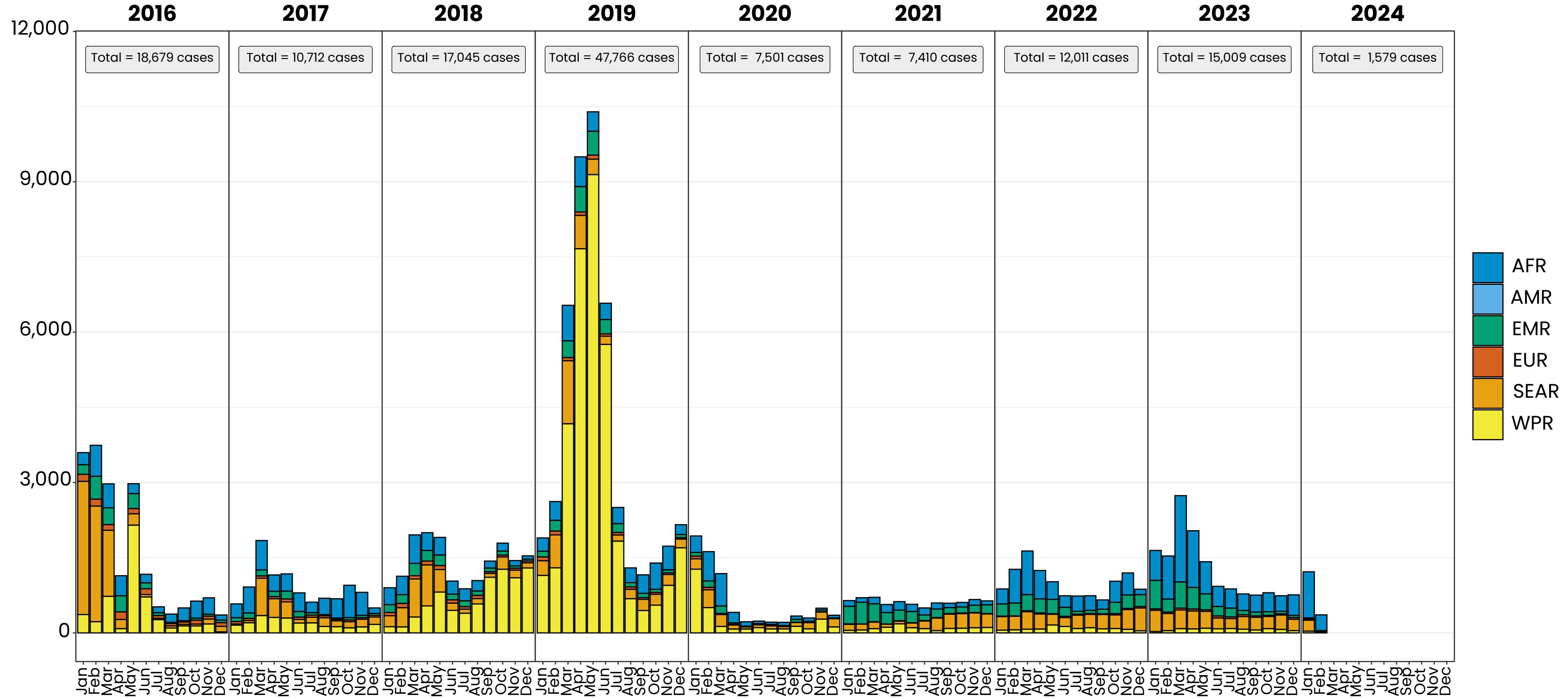
**2023**

Region	Member States*	Rubella cases	Clin	Epi	Lab	Date Received
AFR	44/47	7,512	0	0	7,512	2024-03
AMR	24/35	0	0	0	0	2024-03
EMR	21/21	2,795	1,317	338	1,140	2024-03
EUR	31/53	384	261	4	119	2024-03
SEAR	11/11	3,512	0	137	3,375	2024-03
WPR	16/27	806	87	0	719	2024-03
<b>Total</b>	<b>147/194</b>	<b>15,009</b>	<b>1,665</b>	<b>479</b>	<b>12,865</b>	

Region	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
AFR	598	862	1,721	1,134	642	402	383	332	339	379	310	410
AMR	0	0	0	0	0	0	0	0	0	0	0	0
EMR	567	258	523	430	320	190	175	86	77	71	53	45
EUR	29	28	37	40	30	43	33	35	27	25	24	33
SEAR	424	344	373	357	338	213	200	252	253	243	288	227
WPR	25	43	83	78	90	81	85	72	57	82	66	44
<b>Total</b>	<b>1,643</b>	<b>1,535</b>	<b>2,737</b>	<b>2,039</b>	<b>1,420</b>	<b>929</b>	<b>876</b>	<b>777</b>	<b>753</b>	<b>800</b>	<b>741</b>	<b>759</b>

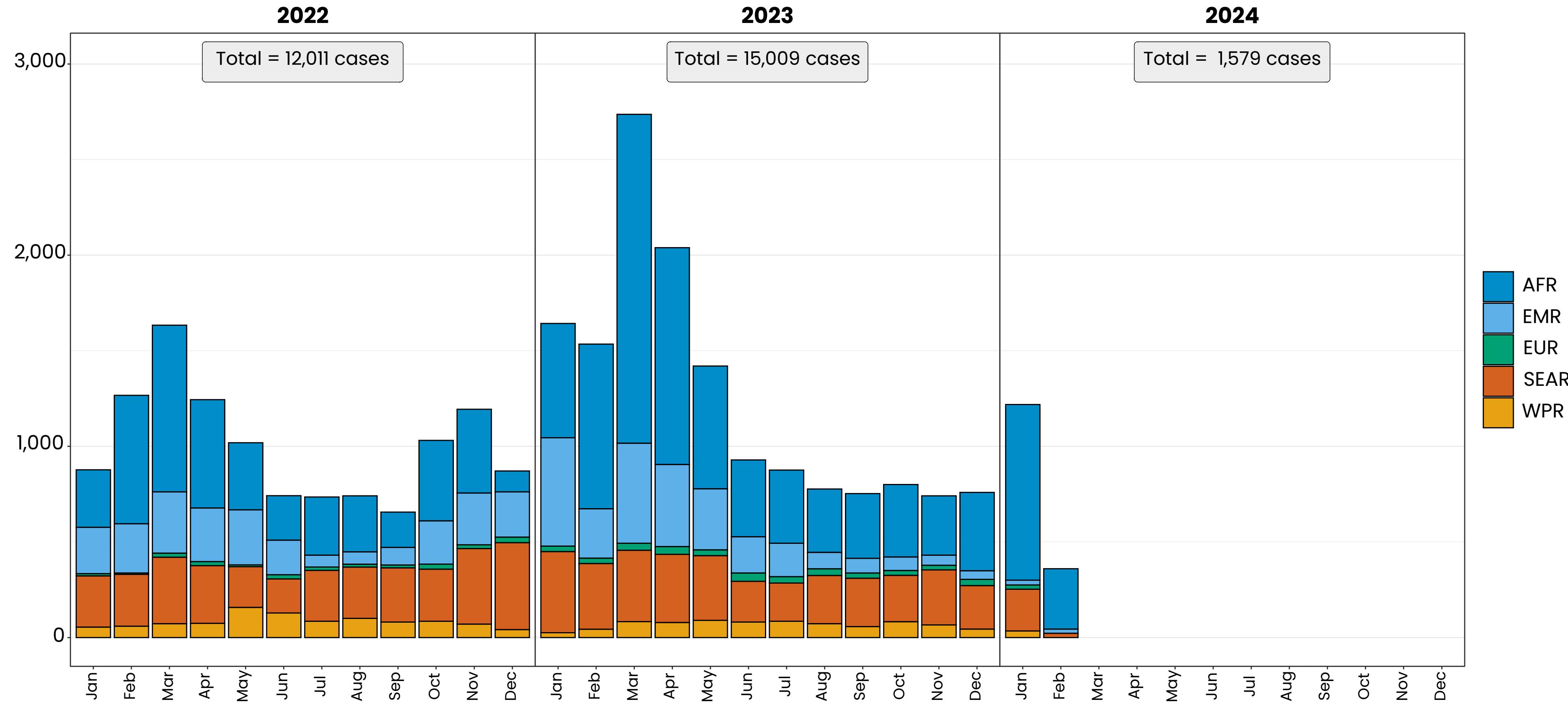
Notes: Based on data received 2024-03 - This is surveillance data, hence for the last month, the data may be incomplete. \* Member States Reporting / Total Member States in Region

# Rubella case distribution by month and WHO Region (2016–2024)



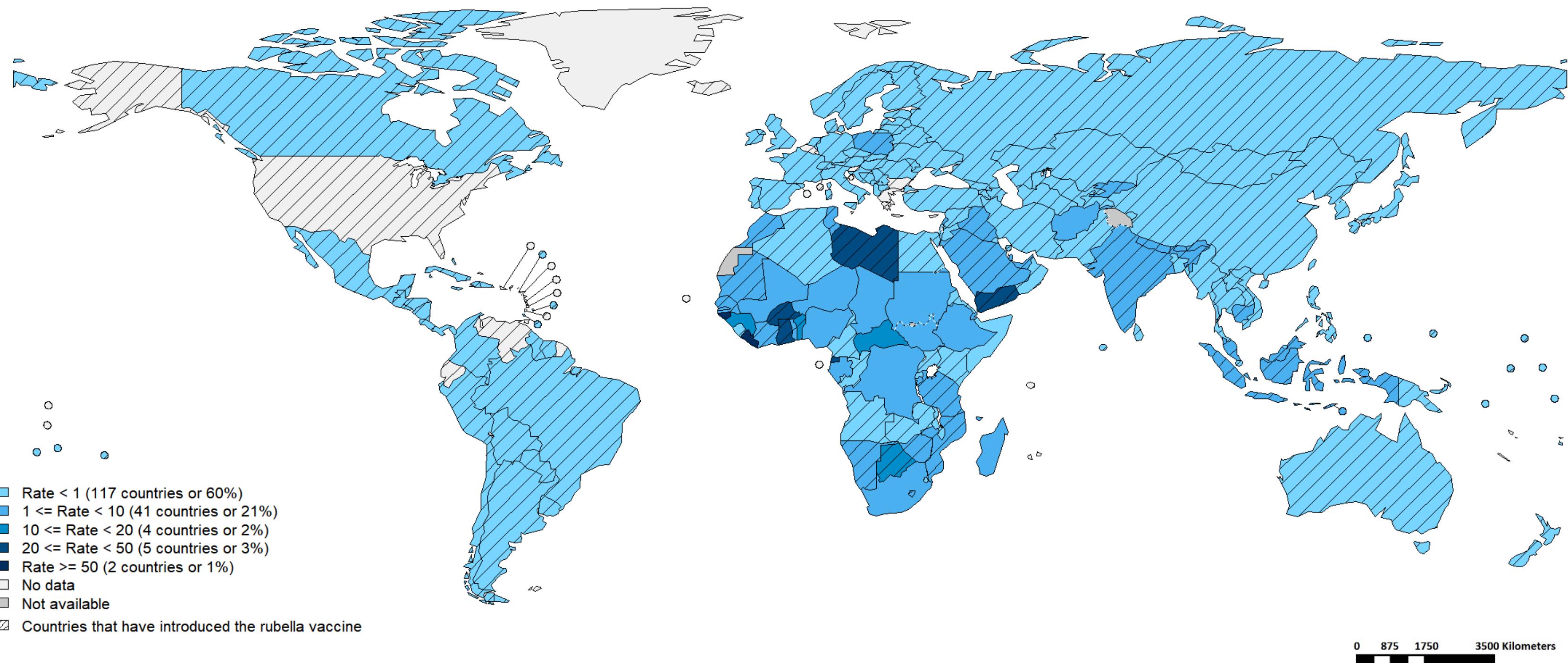
Notes: Based on data received 2024-03 – Data Source: IVB Database – This is surveillance data, hence for the last month(s), the data may be incomplete.

# Rubella case distribution by month and WHO Region (2022-2024)



Notes: Based on data received 2024-03 - Data Source: IVB Database - This is surveillance data, hence for the last month(s), the data may be incomplete.

# Rubella Incidence Rate per Million (12M period)



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Data source: IVB Database

## Disclaimer:

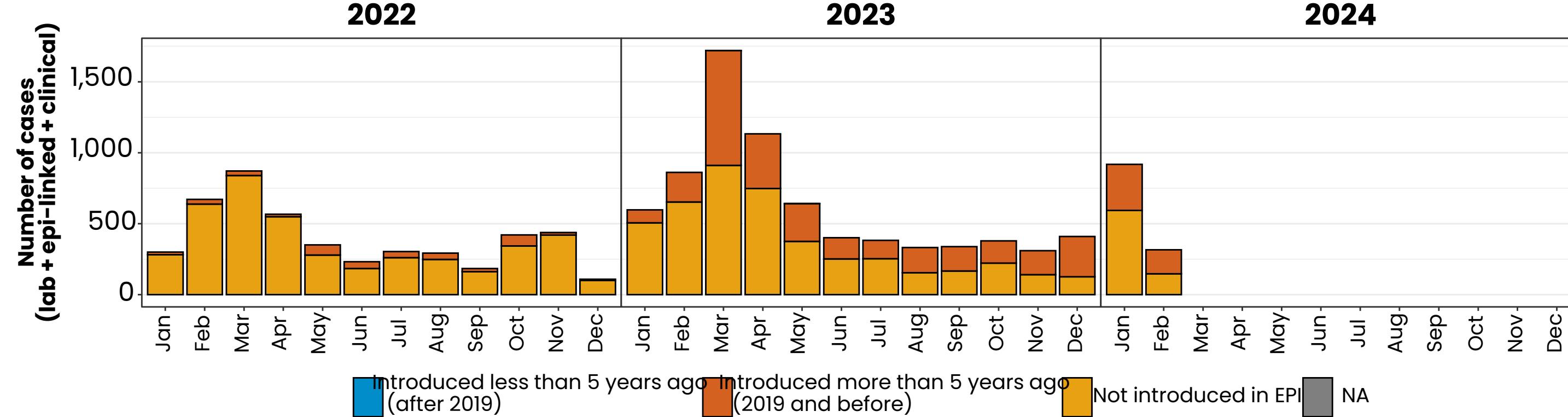
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## Highest incidence rates

Country	Cases	Rate
Liberia	396	73.08
Guinea-Bissau	149	69.28
Eq. Guinea	83	48.41
Burkina Faso	949	40.81
Ghana	1199	35.14
Yemen	975	28.30
Libya	139	20.18
Botswana	53	19.81
Central African Republic	96	16.72
Guinea	231	16.28

# Rubella cases (AFR)

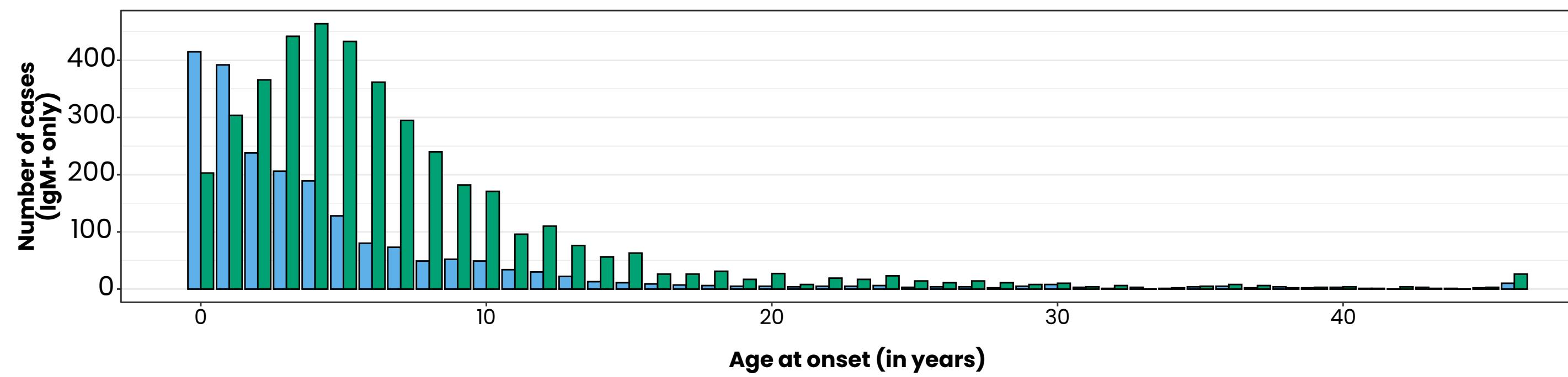
AFR Rubella Case Distribution (January 2022-March 2024)



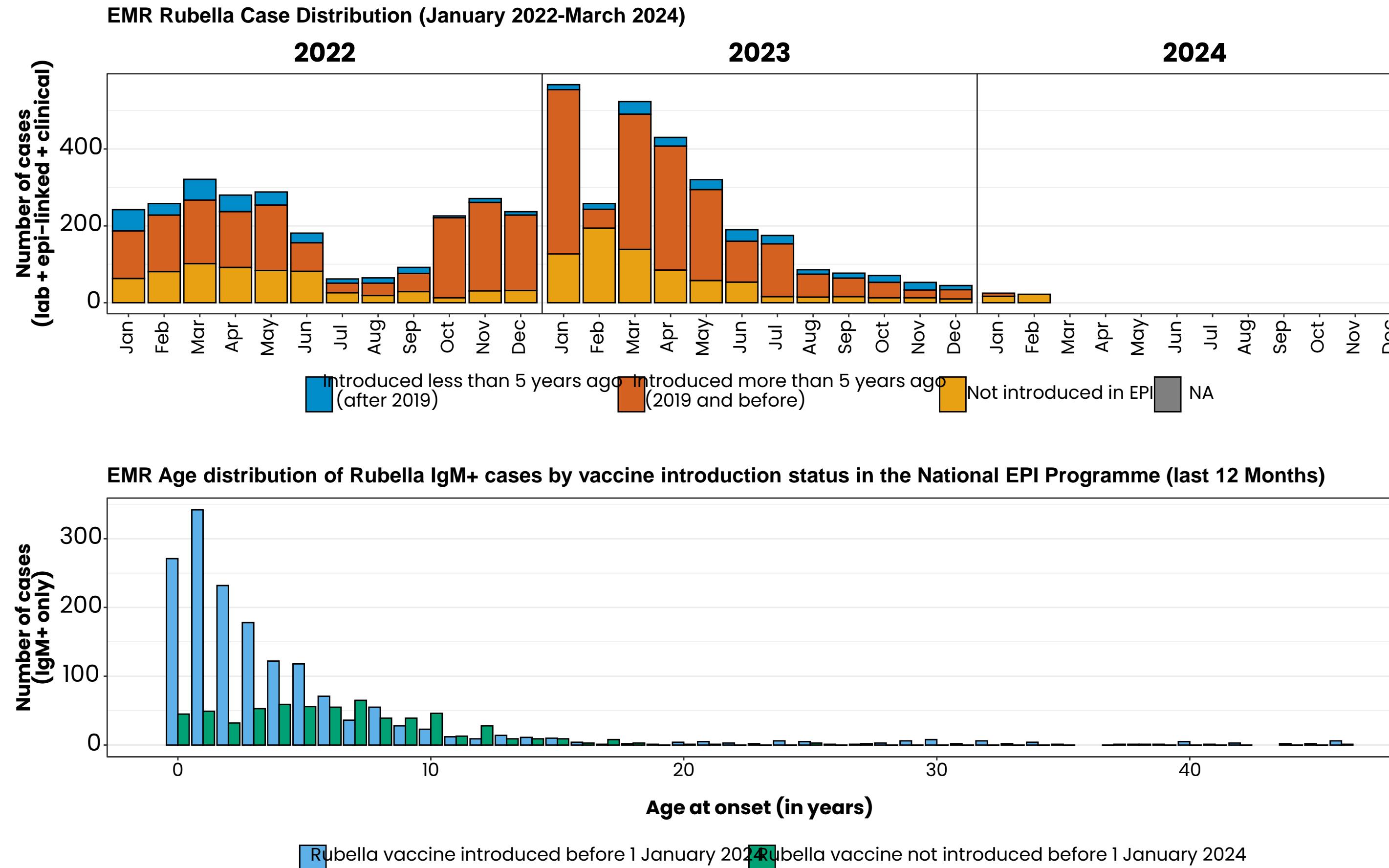
Top 10 countries (last 12 M)

Country	RCV in RI	Cases	% of Total
Others	-	1395	19
Nigeria	No	1258	17
Ghana	2013	1186	16
Burkina Faso	2015	914	13
Ethiopia	No	682	9
DR Congo	No	602	8
Liberia	No	330	5
Madagascar	No	267	4
Benin	2019	223	3
United Republic of Tanzania	2014	221	3
Guinea	No	209	3

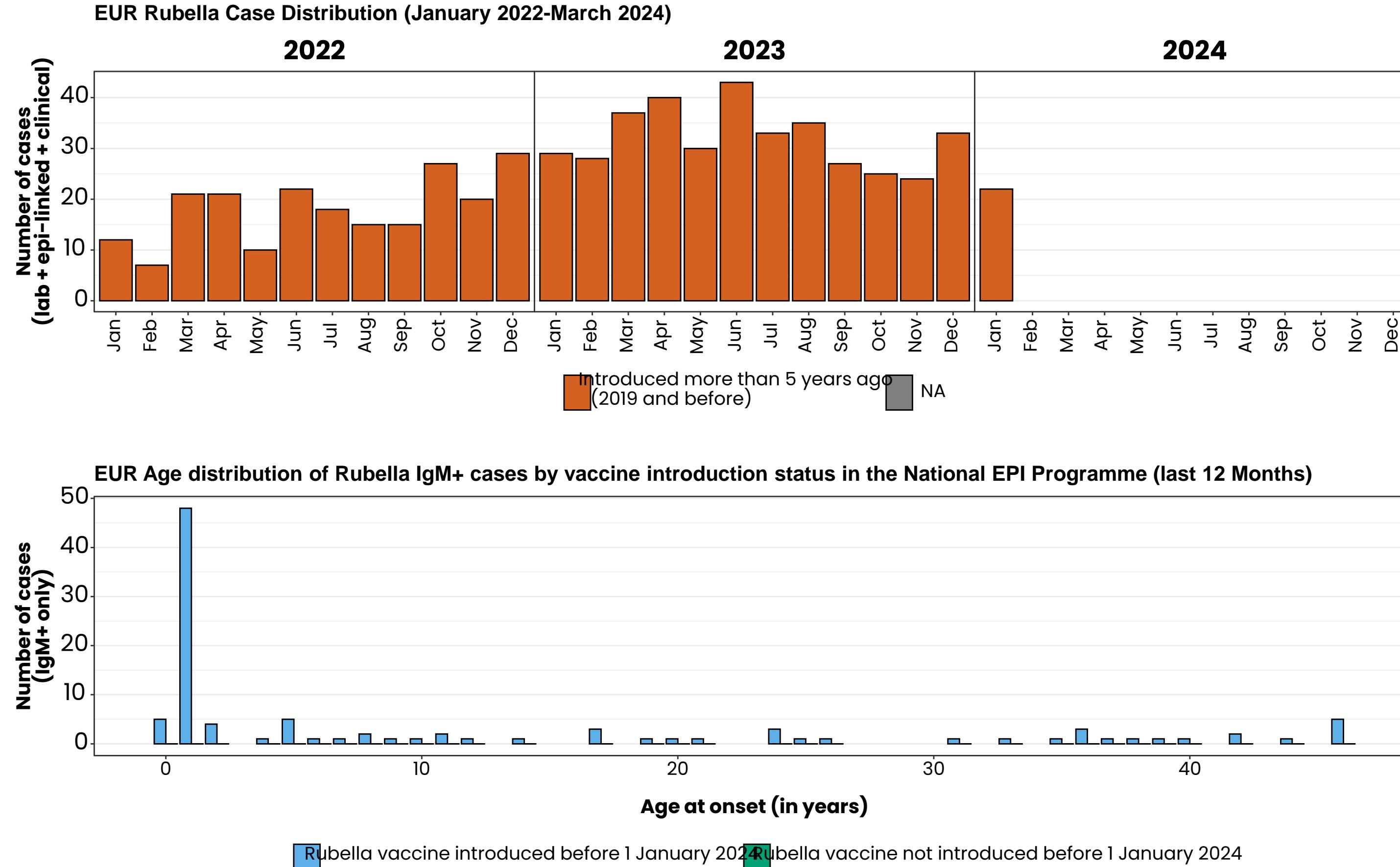
AFR Age distribution of Rubella IgM+ cases by vaccine introduction status in the National EPI Programme (last 12 Months)



# Rubella cases (EMR)



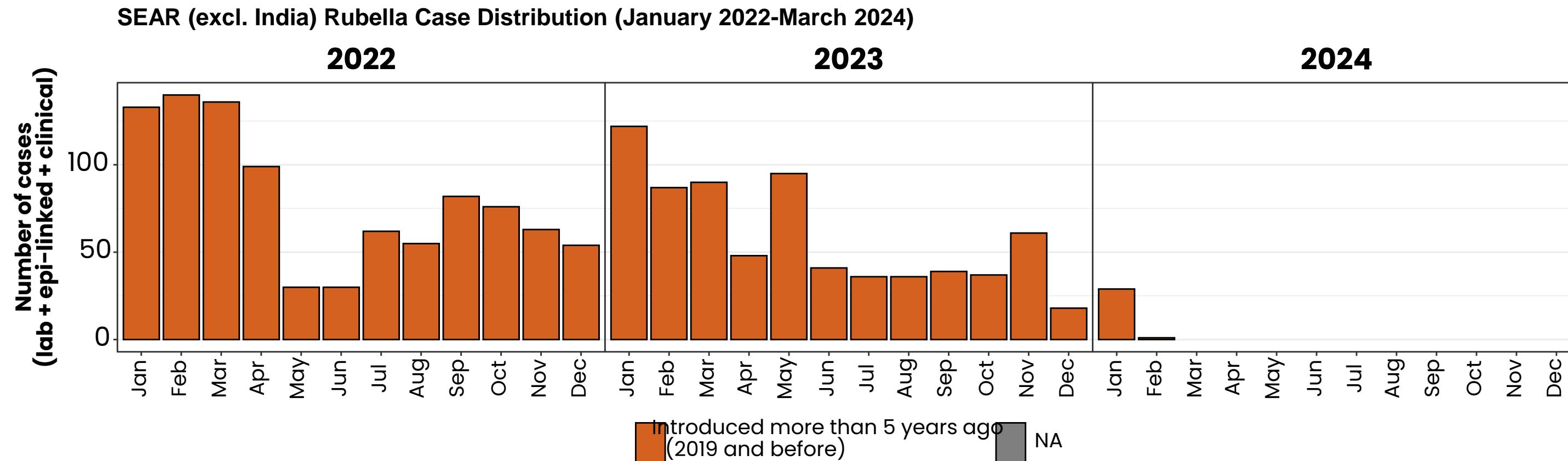
# Rubella cases (EUR)



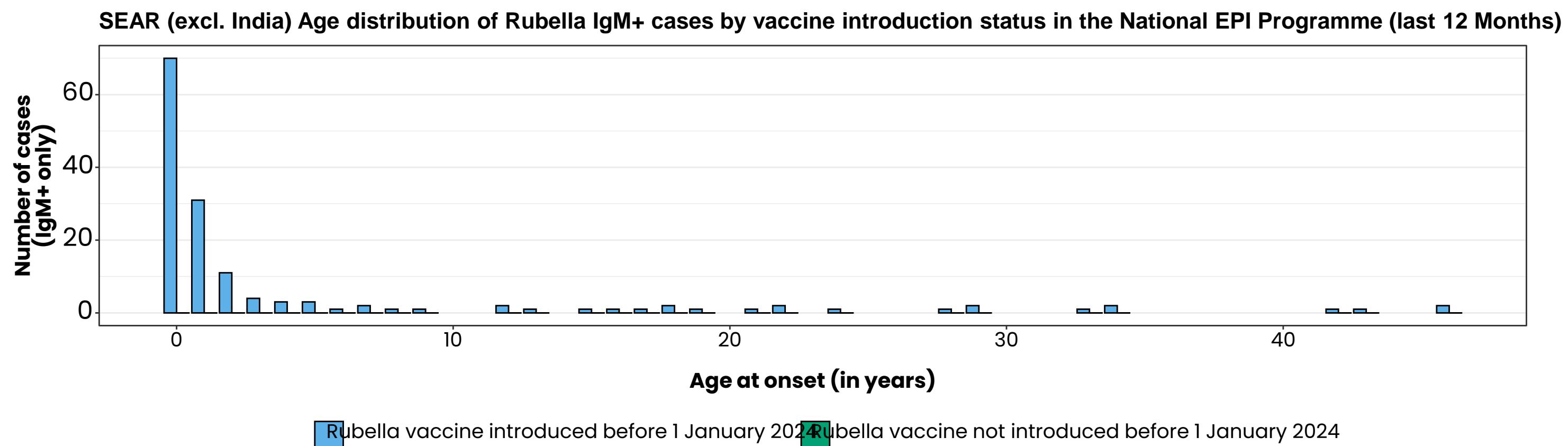
Top 10 countries (last 12 M)			
Country	RCV in RI	Cases	% of Total
Poland	1988	247	71
Türkiye	2006	49	14
Kazakhstan	2004	12	3
Ukraine	2003	10	3
Germany	1991	7	2
Tajikistan	2009	7	2
Kyrgyzstan	2001	6	2
Others	-	5	1
Russian Federation	2000	3	1
Uzbekistan	2006	2	1
Bosnia and Herzegovina	1976	1	0

Notes: Based on data received 2024-03 Data Source: IVB Database. Spikes in age-distribution curve are an artifact of reporting by age bands ( 0=<1 yrs, 2=1-4 yrs, 7=5-9 yrs, 12=10-14 yrs, 17=15-19 yrs, 25=20-29 yrs, 45=30+ yrs) instead of by age from some member states.

# Rubella cases (SEAR (excl. India))

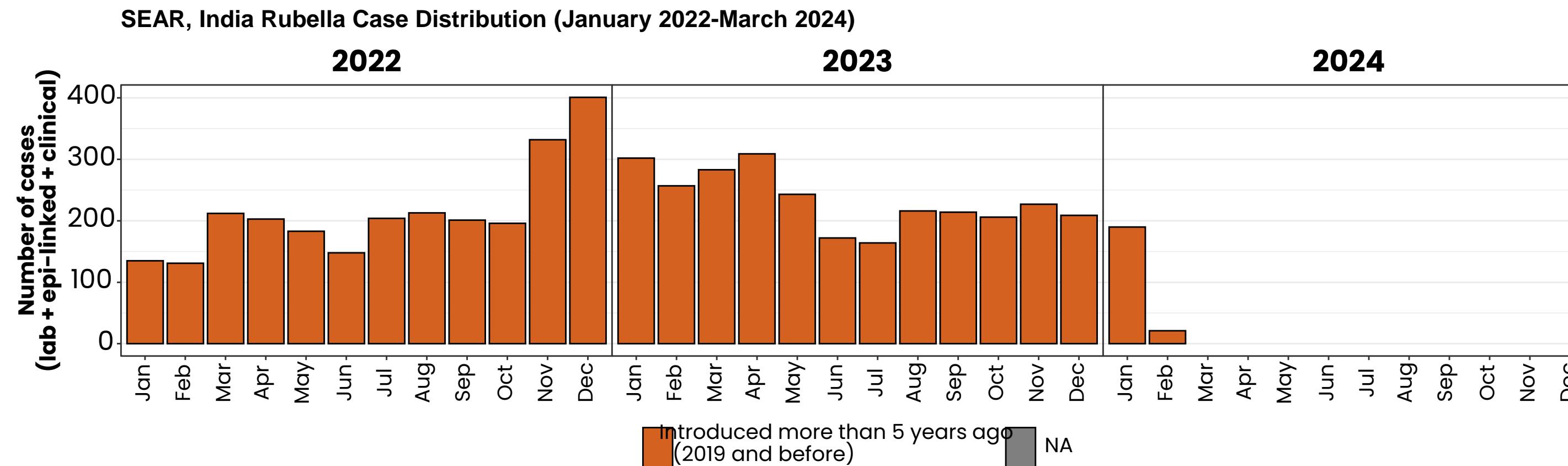


Top 10 countries (last 12 M)			
Country	RCV in RI	Cases	% of Total
Indonesia	2018	370	70
Bangladesh	2012	108	20
Nepal	2013	28	5
Thailand	1997	12	2
Bhutan	2006	5	1
Timor-Leste	2016	5	1
Myanmar	2015	3	1

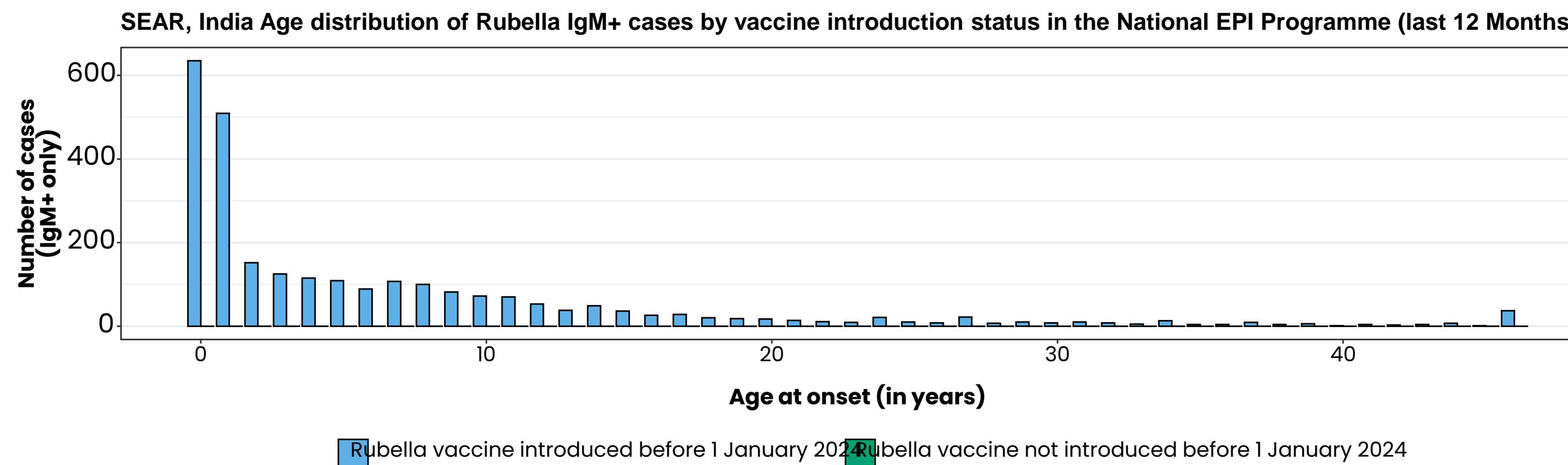


Notes: Based on data received 2024-03 Data Source: IVB Database.

# Rubella cases (SEAR, India)

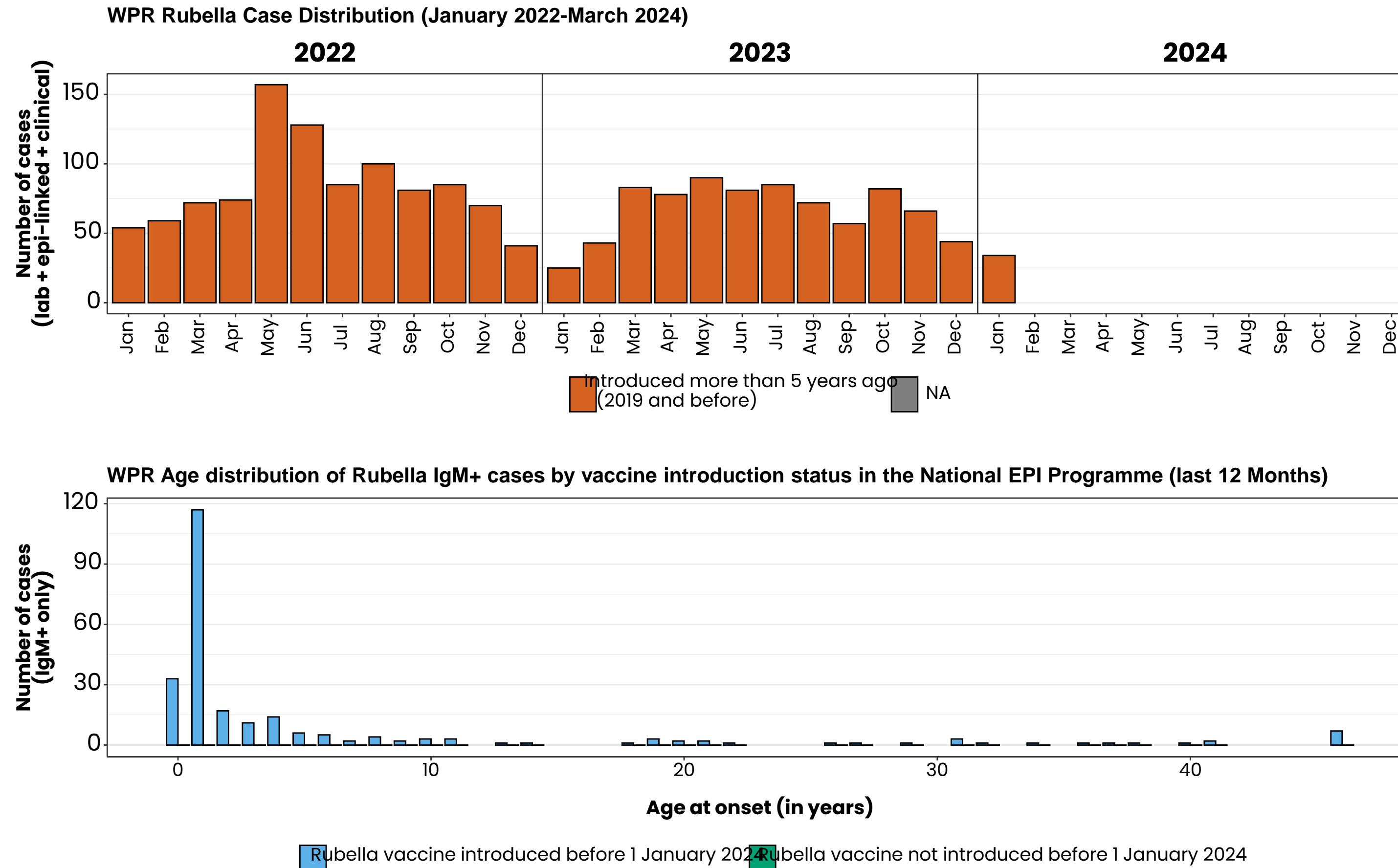


Top 10 countries (last 12 M)			
Country	RCV in RI	Cases	% of Total
India	2018	2454	100



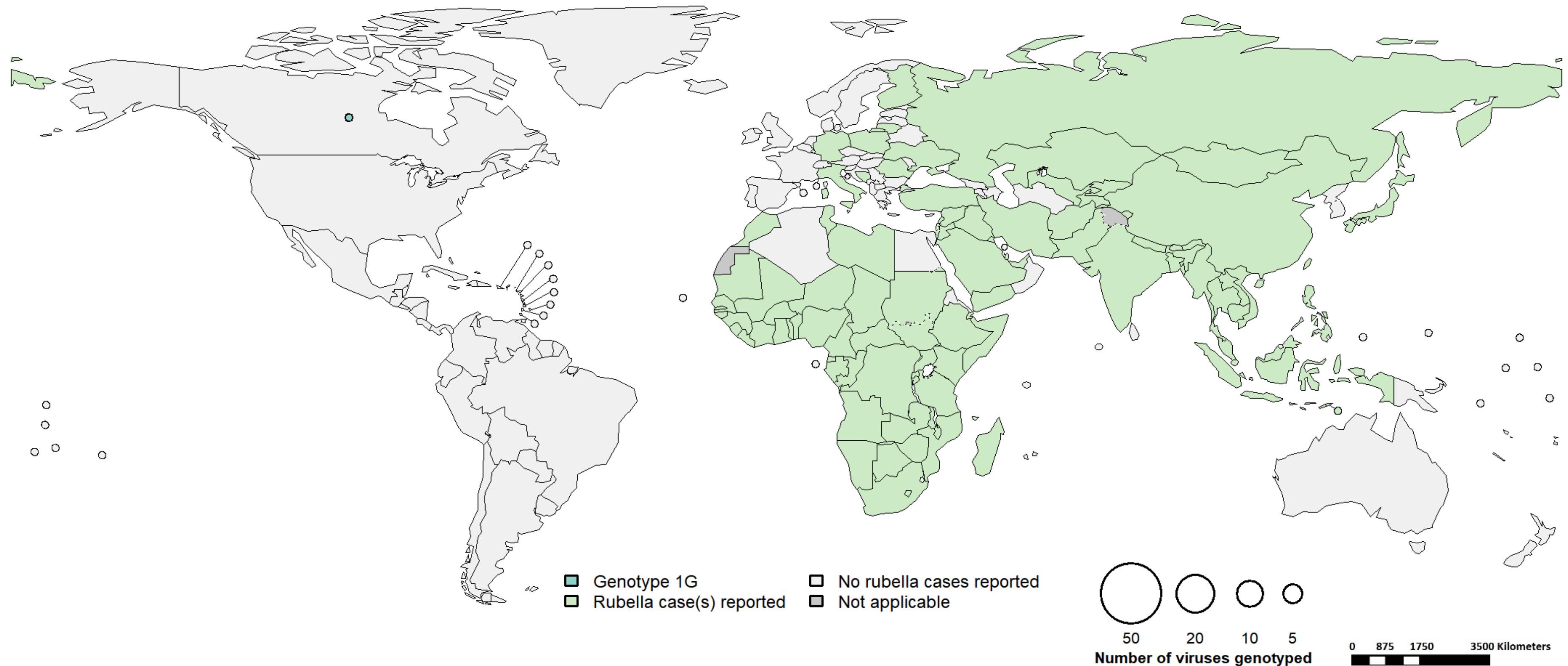
Notes: Based on data received 2024-03 Data Source: IVB Database.

# Rubella cases (WPR)



Top 10 countries (last 12 M)			
Country	RCV in RI	Cases	% of Total
China	2008	540	70
Philippines	2010	85	11
Malaysia	2004	69	9
Viet Nam	2015	41	5
Cambodia	2013	22	3
Japan	1995	12	2
Lao People's Democratic Republic	2012	1	0
Mongolia	2009	1	0
Singapore	1982	1	0

# Distribution of rubella genotypes (last 12 months)



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Data source: IVB & RubeNS Databases

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# Measles and Rubella IgM Data Summary

**2024**

Region	Member States*	Specimens received	Measles tested	Measles positive n(%)	Measles equivocal n(%)	Measles negative n(%)	Rubella tested	Rubella positive n(%)	Rubella equivocal n(%)	Rubella negative n(%)
<b>AFR</b>	8/47	1,974	1,441	594 (41)	30 (2)	817 (57)	1,256	68 (5)	16 (1)	1,172 (93)
<b>AMR</b>	18/35	887	840	34 (4)	23 (3)	783 (93)	811	11 (1)	4 (0)	796 (98)
<b>EMR</b>	12/21	3,573	3,545	1,513 (43)	8 (0)	2,024 (57)	2,531	55 (2)	3 (0)	2,473 (98)
<b>EUR</b>	33/53	10,686	10,584	5,587 (53)	64 (1)	3,906 (37)	6,882	269 (4)	18 (0)	6,580 (96)
<b>SEAR</b>	10/11	7,548	6,179	1,109 (18)	88 (1)	4,953 (80)	5,917	193 (3)	52 (1)	5,655 (96)
<b>WPR</b>	25/27	1,770	1,745	651 (37)	28 (2)	1,058 (61)	1,113	38 (3)	5 (0)	1,066 (96)
<b>Total</b>	<b>106/194</b>	<b>26,438</b>	<b>24,334</b>	<b>9,488 (39)</b>	<b>241 (1)</b>	<b>13,541 (56)</b>	<b>18,510</b>	<b>634 (3)</b>	<b>98 (1)</b>	<b>17,742 (96)</b>

**2023**

Region	Member States*	Specimens received	Measles tested	Measles positive n(%)	Measles equivocal n(%)	Measles negative n(%)	Rubella tested	Rubella positive n(%)	Rubella equivocal n(%)	Rubella negative n(%)
<b>AFR</b>	45/47	71,397	67,841	20,562 (30)	1,308 (2)	45,846 (68)	51,536	4,806 (9)	823 (2)	45,688 (89)
<b>AMR</b>	24/35	5,561	5,607	218 (4)	94 (2)	5,295 (94)	5,426	133 (2)	45 (1)	5,248 (97)
<b>EMR</b>	21/21	87,590	77,819	28,962 (37)	279 (0)	48,578 (62)	72,599	1,837 (3)	297 (0)	70,465 (97)
<b>EUR</b>	38/53	77,244	69,837	36,558 (52)	270 (0)	26,285 (38)	46,901	717 (2)	100 (0)	43,481 (93)
<b>SEAR</b>	10/11	150,949	141,944	47,566 (34)	5,781 (4)	96,236 (68)	102,351	6,889 (7)	4,392 (4)	98,672 (96)
<b>WPR</b>	25/27	17,213	16,004	2,882 (18)	278 (2)	12,834 (80)	13,572	687 (5)	92 (1)	12,789 (94)
<b>Total</b>	<b>163/194</b>	<b>409,954</b>	<b>379,052</b>	<b>136,748 (36)</b>	<b>8,010 (2)</b>	<b>235,074 (62)</b>	<b>292,385</b>	<b>15,069 (5)</b>	<b>5,749 (2)</b>	<b>276,343 (95)</b>

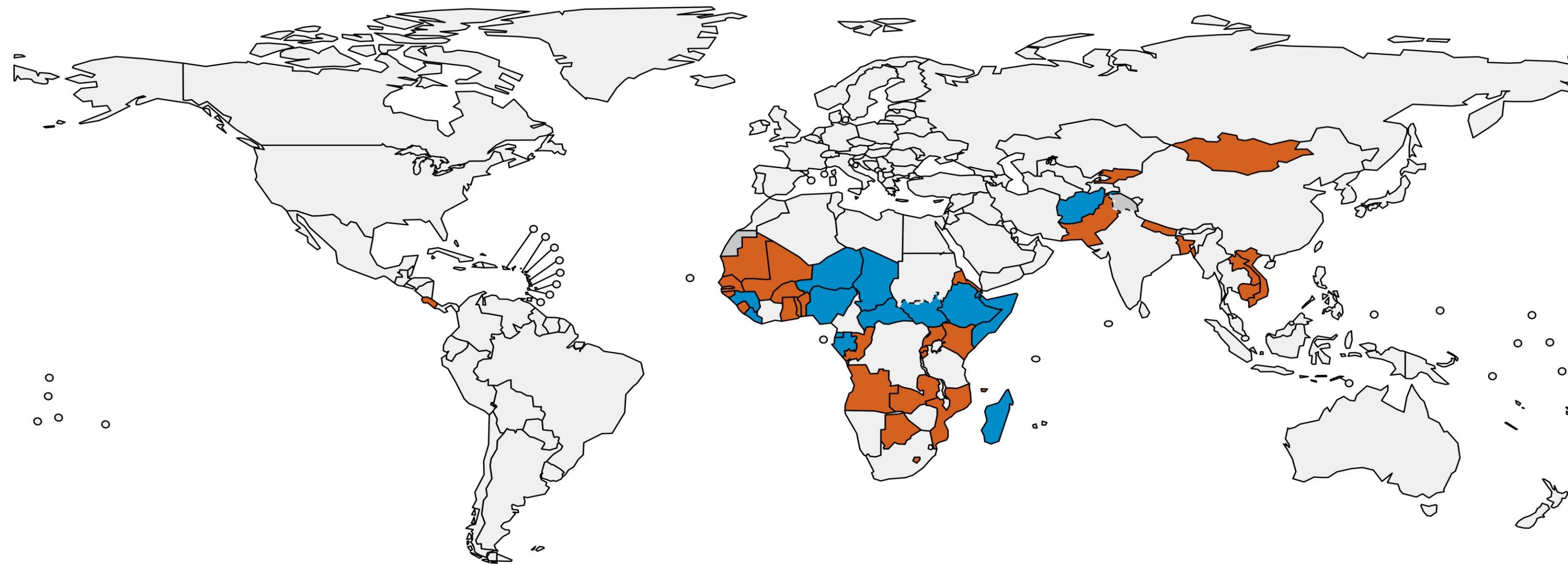
# **Supplementary Immunization Activities**



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# Upcoming MMR, MR and Measles campaigns (2024-2025)



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Data source: IVB Database

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0 875 1750 3500 Kilometers

■ Measles ■ MR □ No campaign planned □ Not applicable

# Upcoming MMR, MR and Measles campaigns (2024-2025)

Year	Region	Name	Type	Intervention	StartDate	Status	Age Group(s)	Extent	Target
2024	AFR	Benin	FollowUp	MR	2024-??-??	Planned	9-59 M	NATIONAL	2136671
2024	AFR	Burkina Faso	FollowUp	MR	2024-??-??	Planned	9-59 M	SUBNATIONAL	2489503
2024	AFR	Chad	FollowUp	MEASLES	2024-??-??	Planned	9-59 M	-	3217682
2024	AFR	Equatorial Guinea	FollowUp	MEASLES	2024-??-??	Planned	9-59 M	NATIONAL	229691
2024	AFR	Eritrea	FollowUp	MR	2024-??-??	Planned	9-59 M	NATIONAL	485895
2024	AFR	Ghana	FollowUp	MR	2024-??-??	Planned	9-59 M	NATIONAL	4306120
2024	AFR	Guinea	FollowUp	MEASLES	2024-??-??	Planned	9-59 M	NATIONAL	2096582
2024	AFR	Guinea-Bissau	CatchUp	MR	2024-??-??	Planned	9 M-14 Y	NATIONAL	835870
2024	AFR	Liberia	FollowUp	MEASLES	2024-??-??	Planned	9-59 M	NATIONAL	745354
2024	AFR	Madagascar	FollowUp	MEASLES	2024-??-??	Planned	9-59 M	NATIONAL	4150959
2024	AFR	Mali	CatchUp	MR	2024-??-??	Planned	9 M-14 Y	NATIONAL	9299172
2024	AFR	Mauritania	FollowUp	MR	2024-??-??	Planned	9-59 M	NATIONAL	694681
2024	AFR	Mozambique	FollowUp	MR	2024-??-??	Planned	9 M-9 Y	NATIONAL	10825766
2024	AFR	Nigeria	FollowUp	MEASLES	2024-??-??	Planned	9-59 M	SUBNATIONAL	18745590
2024	AFR	Rwanda	FollowUp	MR	2024-??-??	Planned	9-59 M	NATIONAL	1222298
2024	AFR	Sierra Leone	FollowUp	MR	2024-??-??	Planned	9-59 M	NATIONAL	1134403
2024	AFR	Zambia	FollowUp	MR	2024-??-??	Planned	9 M-10 Y	NATIONAL	6335169
2024	AMR	Costa Rica	FollowUp	MR	2024-??-??	Planned	1-5 Y	NATIONAL	-
2024	EUR	Kyrgyzstan	FollowUp	MR	2024-??-??	Planned	9-84 M	-	509272
2024	SEAR	Nepal	FollowUp	MR	2024-??-??	Planned	9-59 M	NATIONAL	5742993
2024	WPR	Cambodia	FollowUp	MR	2024-??-??	Planned	6-59 M	NATIONAL	1613063
2024	WPR	Lao People's Democratic Republic	FollowUp	MR	2024-??-??	Planned	9-59 M	NATIONAL	789706
2024	WPR	Mongolia	Campaign	MR	2024-??-??	Planned	-	NATIONAL	-
2024	WPR	Viet Nam	Campaign	MR	2024-??-??	Planned	-	-	-

# Upcoming MMR, MR and Measles campaigns (2024-2025)

Year	Region	Name	Type	Intervention	StartDate	Status	Age Group(s)	Extent	Target
2025	AFR	Angola	FollowUp	MR	2025-??-??	Planned	9-59 M	NATIONAL	5983408
2025	AFR	Botswana	FollowUp	MR	2025-??-??	Planned	9-59 M	NATIONAL	148268
2025	AFR	Burundi	FollowUp	MR	2025-??-??	Planned	9-59 M	NATIONAL	2053824
2025	AFR	Central African Republic	FollowUp	MEASLES	2025-??-??	Planned	9-59 M	NATIONAL	984810
2025	AFR	Comoros	FollowUp	MR	2025-??-??	Planned	9-59 M	NATIONAL	113688
2025	AFR	Congo	FollowUp	MR	2025-??-??	Planned	9-59 M	NATIONAL	846894
2025	AFR	Eswatini	FollowUp	MR	2025-??-??	Planned	9-59 M	NATIONAL	140066
2025	AFR	Ethiopia	FollowUp	MEASLES	2025-??-??	Planned	9-59 M	NATIONAL	17797907
2025	AFR	Gabon	FollowUp	MEASLES	2025-??-??	Planned	9-59 M	NATIONAL	306528
2025	AFR	Gambia	FollowUp	MR	2025-??-??	Planned	9-59 M	NATIONAL	412351
2025	AFR	Kenya	FollowUp	MR	2025-??-??	Planned	9-59 M	NATIONAL	6913106
2025	AFR	Lesotho	FollowUp	MR	2025-??-??	Planned	9-59 M	NATIONAL	274805
2025	AFR	Niger	FollowUp	MEASLES	2025-??-??	Planned	9-59 M	NATIONAL	4972177
2025	AFR	Senegal	FollowUp	MR	2025-??-??	Planned	9-59 M	NATIONAL	2570764
2025	AFR	South Sudan	FollowUp	MEASLES	2025-??-??	Planned	6-59 M	NATIONAL	1485839
2025	AFR	Togo	FollowUp	MR	2025-??-??	Planned	9-59 M	NATIONAL	1270432
2025	AFR	Uganda	FollowUp	MR	2025-??-??	Planned	9-59 M	NATIONAL	7685529
2025	EMR	Afghanistan	FollowUp	MEASLES	2025-??-??	Planned	9-59 M	NATIONAL	6490553
2025	EMR	Djibouti	FollowUp	MEASLES	2025-??-??	Planned	9-59 M	NATIONAL	116371
2025	EMR	Pakistan	FollowUp	MR	2025-??-??	Planned	9-59 M	NATIONAL	29604478
2025	EMR	Somalia	FollowUp	MEASLES	2025-??-??	Planned	9-59 M	NATIONAL	3200130
2025	SEAR	Bangladesh	FollowUp	MR	2025-??-??	Planned	9-59 M	NATIONAL	14663335

# WHO Bulletins and Newsletters

- AFR (webpages under migration)
- AMR: [PAHO measles and rubella weekly bulletin](#) (published every Friday)
- EMR: [EMRO measles home page](#)
- EUR : [EURO EpiData update](#)
- SEAR: (webpages under migration)
- WPR: [WPRO measles monthly Bulletin](#)

(switch to presentation mode if links are inactive)