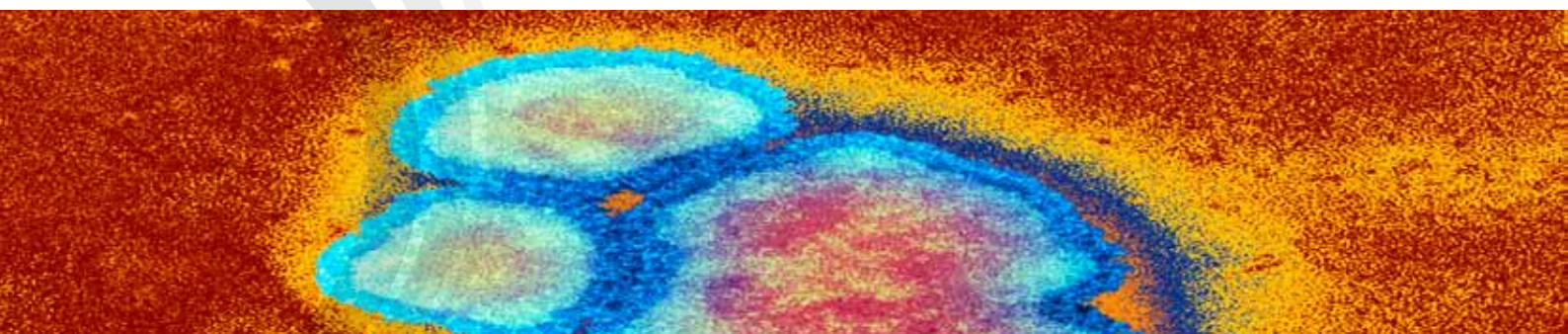


SURVEILLANCE REPORT



Measles and rubella surveillance

2017

ECDC SURVEILLANCE REPORT

Measles and rubella surveillance

2017



This report of the European Centre for Disease Prevention and Control (ECDC) was coordinated by Emmanuel Robesyn and Olivia Aya Nakitanda.

Acknowledgements

We would like to thank all the EU/EEA operational focal points for measles and rubella and the national focal points for vaccine-preventable diseases for their dedication in reporting measles and rubella data on a monthly basis. We are thankful to colleagues who supported the production of this report: Grazina Mirinaviciute, Emmanouela Sdoná, Joana Gomes Dias, Helen Johnson, and Tarik Derrough. Data support was provided by Adrian Prodan. Maps were produced by Silviu Lucian Ionescu. We also acknowledge the collaboration with the Vaccine-preventable Diseases and Immunization programme of the WHO Regional Office for Europe, Copenhagen.

Suggested citation: European Centre for Disease Prevention and Control. Measles and rubella surveillance – 2017. Stockholm: ECDC; 2018.

Stockholm, April 2018

ISBN 978-92-9498-179-0

doi: 10.2900/11947

Catalogue number TQ-04-18-387-EN-N

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Abbreviations

CDTR	Communicable Disease Threats Report
EU/EEA	European Union/European Economic Area
MMR	Measles, mumps and rubella
RVC	Regional Verification Commission for Measles and Rubella Elimination
TESSy	European Surveillance System
WHO	World Health Organization

Executive summary

The annual report on measles and rubella for 2017 is based on surveillance data retrieved from the European Surveillance System (TESSy) on 28 February 2018.

Measles

- In 2017, the EU/EEA experienced a resurgence of measles with several outbreaks and 37 fatalities.
- Twenty-eight EU/EEA countries reported 14 600 measles cases which translates into an overall incidence of 28.3 cases per million population. Sixty-one percent of these cases were laboratory confirmed.
- Most cases (>75%) were reported during the first half of the year with a peak in March followed by fewer cases until the end of the year. This pattern is similar to previous years.
- The highest numbers of cases were reported by Romania (5 608), Italy (5 098), Greece (967) and Germany (929). Latvia and Malta reported zero cases in 2017.
- The countries with the highest notification rates were Romania (283.8 cases per million), Greece (89.7 cases per million), Italy (84.0 cases per million) and Belgium (32.5 cases per million).
- Adults aged ≥ 20 years (38% of all cases) and children aged <5 years (37%) were the most affected. The highest incidences, 365.9 and 164.4 cases per million population, were observed in children aged <1 year and 1–4 years respectively.
- The majority of cases occurred in unvaccinated individuals, and the proportion of those unvaccinated ranged from 72% in 25–29 year-olds, to 96% in children aged <1 year, who are too young to receive the vaccination.

Rubella

- In 2017, 11 EU/EEA countries reported 696 rubella cases, which represented a marked decrease from 1 264 and 2 161 cases reported in 2016 and 2015 respectively. Seventeen countries reported zero cases in 2017.
- Poland reported 71% of all reported cases and had the highest incidence (30.1 cases per million), however, only 1% of the 469 cases were laboratory confirmed. Forty-seven percent of cases in Poland occurred in children aged <5 years.

Progress towards WHO elimination goals

Measles and rubella are set for elimination in Europe. At the last meeting of the Regional Verification Commission for Measles and Rubella Elimination in June 2017, 22 EU/EEA countries were declared to have eliminated endemic transmission (i.e. absence of endemic cases for at least 36 months) of measles and 21 EU/EEA countries had eliminated endemic transmission of rubella, based on 2016 data. In addition, four EU/EEA countries were assessed to have interrupted endemic transmission of measles, and two EU/EEA countries endemic transmission of rubella, for less than 36 months. Four EU/EEA countries were still endemic for measles and seven EU/EEA countries were still endemic for rubella.

The vaccination coverage in 2016 for the second dose of measles-containing vaccine was at least 95% (which is the target value), in only seven of 29 EU/EEA countries providing data. For the first dose, 13 of 30 countries providing data met the target. In eight of 30 EU/EEA countries providing data for 2016, the vaccination coverage for the first dose of rubella-containing vaccine was at least 95%.

For 2017, the endemic incidence of measles met the elimination target of less than one case per million population in 9 of 30 reporting EU/EEA countries. The incidence of endemic rubella cases met the elimination target of less than one case per million population in 25 of the 28 reporting EU/EEA countries.

The epidemiological situation and progress indicators in 2017 suggest sustained, re-established or potential endemic transmission of measles across Member States. To reach the goal of eliminating measles and rubella in the EU/EEA, reinforcement of the four key regional strategies aimed at optimising vaccination coverage and surveillance quality is essential.

Introduction

The European Centre for Disease Prevention and Control (ECDC) conducts both indicator- and event-based surveillance of measles. Indicator-based surveillance is conducted through the European Surveillance System (TESSy) which is a system for the collection, analysis and dissemination of data on communicable diseases.

Surveillance reports on measles and rubella are presented monthly [1]; annually [2]; and through ECDC's online Surveillance Atlas of Infectious Diseases, which is updated monthly [3,4].

ECDC also monitors measles and rubella outbreaks in Europe through epidemic intelligence, publishing the most recent updates in the Communicable Disease Threats Report (CDTR) [5]. The monthly surveillance report and the monthly measles updates in the CDTR supplement each other and are published on the same day.

As outbreaks or public health events develop, ECDC may conduct rapid risk assessments to support Member States and the European Commission in their preparedness and response to public health threats. In March 2017, a rapid risk assessment on the measles outbreak in Romania was published [6] and in March 2018, a rapid risk assessment on outbreaks throughout the EU/EEA in 2017–2018 was published [7].

Information on measles and rubella clinical presentation, epidemiology and vaccination is available from the ECDC website [8-11] as well as from the World Health Organization (WHO) [12,13].

Measles

Methods

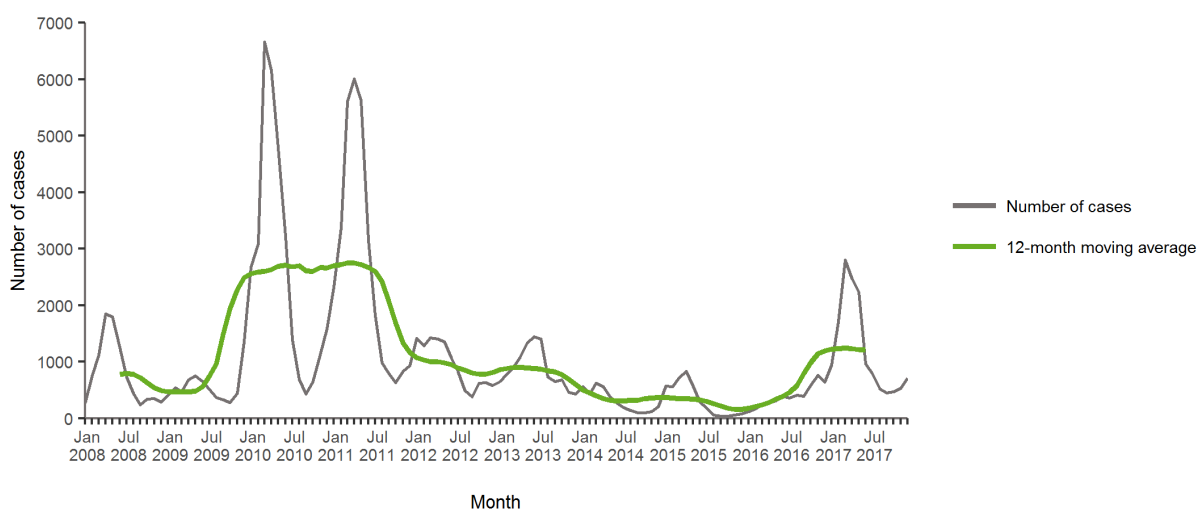
Thirty EU/EEA countries report measles data to TESSy on a monthly basis, in line with the 2012 EU case definitions [14]. All countries report case-based data, except Belgium which has reported aggregated data since May 2016.

This annual report covers measles surveillance data for 2017, retrieved from TESSy on 28 February 2018.

Epidemiology

In 2017, a resurgence of measles was observed in the EU/EEA, following a period of relatively fewer cases since the last major outbreak in 2011 (Figure 1). Figure 1 shows the monthly count of reported measles cases over the past 10 years (2008–2017). Between 1 January 2017 and 31 December 2017, EU/EEA Member States reported 14 600 cases of measles, which was more than triple the number of cases reported for 2016 (4 642) and 2015 (4 000). Several outbreaks were reported across the region [5,7].

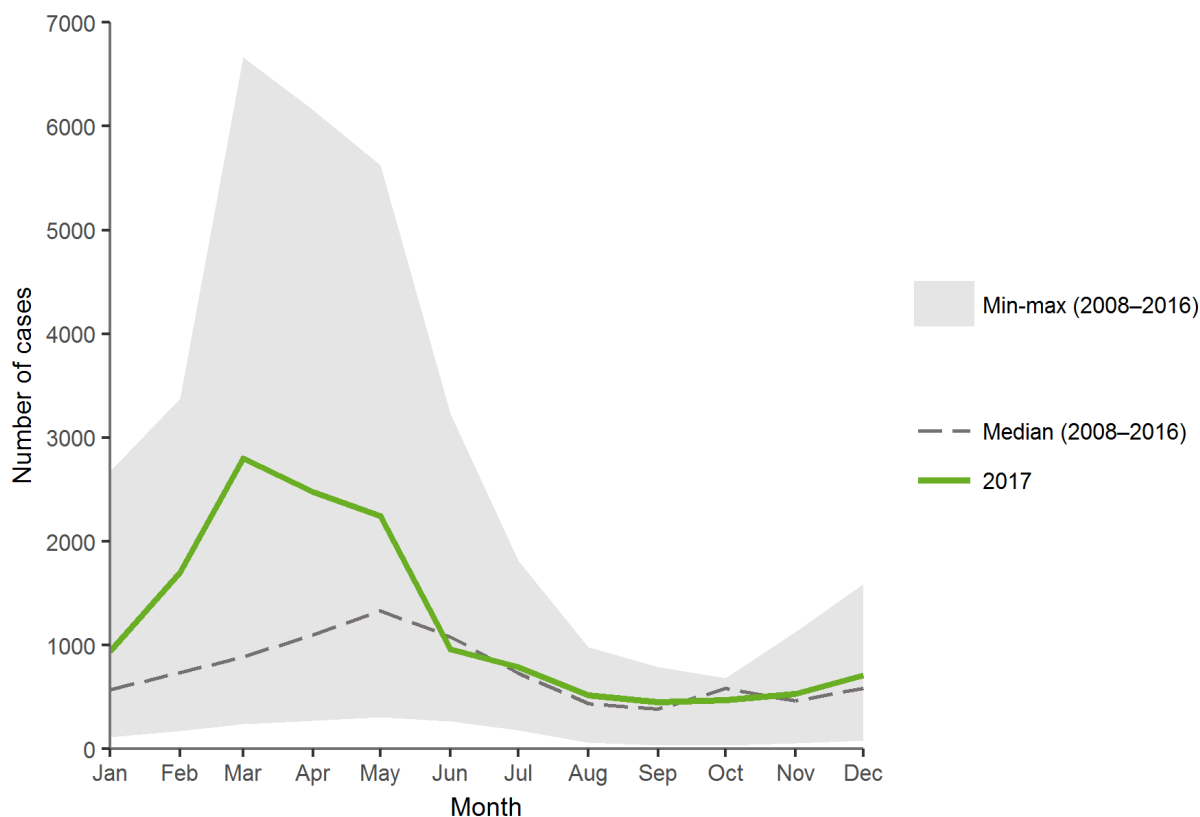
Figure 1. Distribution of measles cases by month, EU/EEA*, 2008–2017



* Between 2008 and 2012, 29 EU/EEA countries reported measles data to TESSy. Since Croatia's accession to the EU in 2013, 30 EU/EEA countries have been reporting measles data to TESSy. Data presented include retrospectively added data from Croatia from 2011 onwards. An estimated 2 239 cases from Romania not yet reported to TESSy for the period from June to December 2017 are not included in the data.

As in previous years, more cases (>75% of reported cases in 2017) were recorded in the first half of the year (Figure 2), with the highest numbers reported in the months of March (2 802), April (2 474) and May (2 244). Following a sharp decline in the number of cases in summer, a slight increase was observed towards the end of the year (Figures 1 and 2).

Figure 2. Distribution of measles cases by month, EU/EEA*, 2017 and 2008–2016



* Between 2008 and 2012, 29 EU/EEA countries reported measles data to TESSy. Since Croatia's accession to the EU in 2013, 30 EU/EEA countries have been reporting measles data to TESSy. Data presented include retrospectively added data from Croatia from 2011 onwards. An estimated 2 239 cases from Romania not yet reported to TESSy for the period from June to December 2017 are not included in the data.

Twenty-eight EU/EEA countries reported measles cases for 2017 (Table 1, Figure 3). Latvia and Malta reported zero cases. Romania reported the highest number of cases for 2017 (5 608, 38% of all cases). Additionally, an estimated 2 239 cases from Romania were not yet reported to TESSy [15]. Other countries with a high number of cases in 2017 were Italy (5 098), Greece (967), Germany (929) and France (518) accounting for 35%, 7%, 6% and 4% of all reported cases respectively.

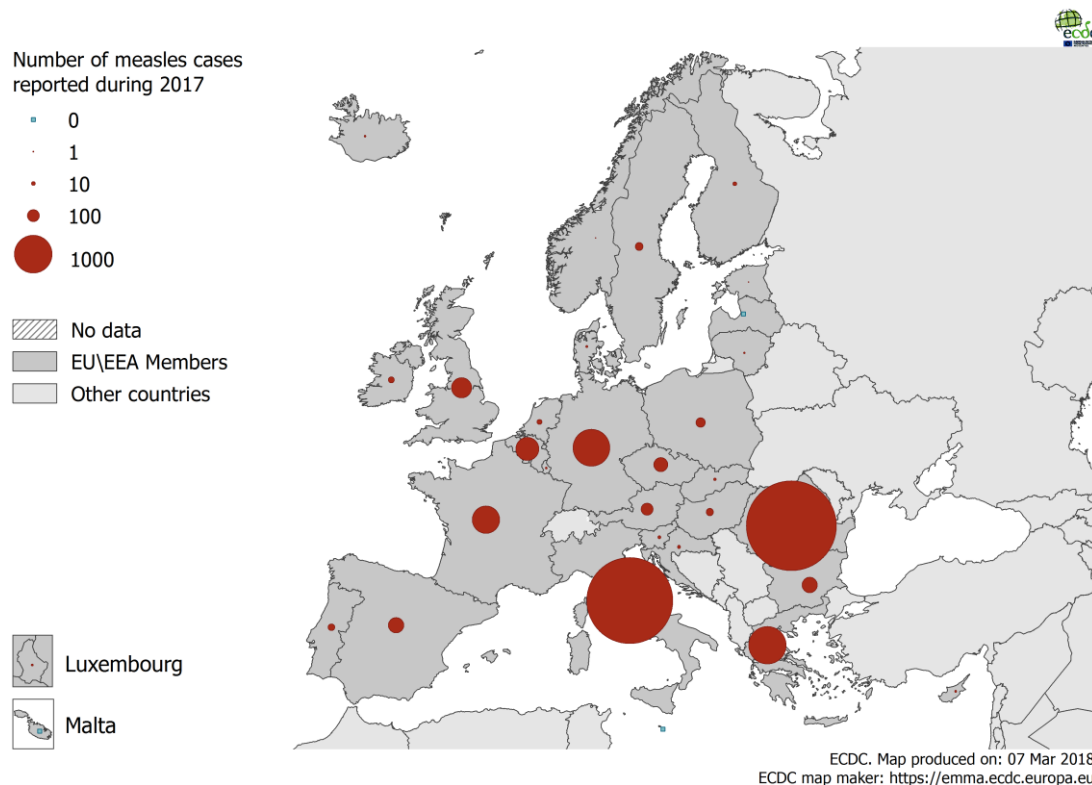
The diagnosis of measles was confirmed by positive laboratory results (serology, virus detection or isolation) in 61% of all reported cases (Table 1). The variation between countries in the proportion of laboratory-confirmed cases (ranging 37% to 100%) is attributable to differences in the total number of cases reported, laboratory practices, and reduced testing during outbreaks when a higher positive predictive value is expected from clinical diagnosis.

Table 1. Distribution of measles cases, EU/EEA, 2017

Country	2017												Total cases	Cases per million	Total lab-positive cases
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Austria	28	34	8	2	6	1	2	2	1	2	8	1	95	10.9	83
Belgium	26	79	150	35	21	34	16	0	2	0	3	1	367	32.5	243
Bulgaria	0	0	19	41	57	44	5	0	0	0	0	0	166	23.2	86
Croatia	2	5	0	0	0	0	0	0	0	0	0	0	7	1.7	7
Cyprus	0	0	0	0	1	2	0	0	0	0	0	0	3	3.5	3
Czech Republic	0	0	21	64	43	7	1	0	0	0	6	4	146	13.8	140
Denmark	0	0	1	0	0	0	0	3	0	0	0	0	4	0.7	4
Estonia	0	0	0	0	1	0	0	0	0	0	0	0	1	0.8	1
Finland	0	0	0	0	0	1	4	5	0	0	0	0	10	1.8	10
France	34	54	49	62	114	43	39	15	19	13	11	65	518	7.8	339
Germany	47	157	212	178	137	77	23	50	16	9	9	14	929	11.3	640
Greece	0	0	0	0	3	1	7	71	126	167	250	342	967	89.7	568
Hungary	1	11	3	0	0	0	9	10	1	1	0	0	36	3.7	36
Iceland	0	0	2	0	0	0	0	0	0	0	1	0	3	9.0	3
Ireland	0	0	1	0	0	0	0	0	0	10	9	5	25	5.3	23
Italy	288	471	943	816	744	602	543	236	160	126	65	104	5 098	84.0	4 042
Latvia	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
Lithuania	0	0	0	1	0	0	1	0	0	0	0	0	2	0.7	2
Luxembourg	0	0	3	0	0	0	0	0	0	0	1	0	4	6.9	4
Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
Netherlands	0	0	0	2	6	2	1	1	1	3	0	0	16	0.9	15
Norway	0	0	0	0	0	0	1	0	0	0	0	0	1	0.2	1
Poland	6	6	5	4	2	4	6	1	12	13	3	1	63	1.7	40
Portugal	0	2	10	18	4	0	0	0	0	0	0	0	34	3.3	29
Romania	484	843	1 338	1 220	1 029	100	100	100	91	101	102	100	5 608	283.8	2 075
Slovakia	0	0	0	1	0	0	0	0	0	0	0	5	6	1.1	6
Slovenia	2	4	0	0	0	0	0	0	0	0	0	1	7	3.4	7
Spain	11	30	22	10	38	19	9	10	2	0	1	11	163	3.5	154
Sweden	2	8	7	3	4	0	0	2	2	2	0	11	41	4.2	41
United Kingdom	10	1	8	17	34	25	22	12	18	22	65	46	280	4.3	280
EU/EEA	941	1 705	2 802	2 474	2 244	962	789	518	451	469	534	711	14 600	28.3	8 882

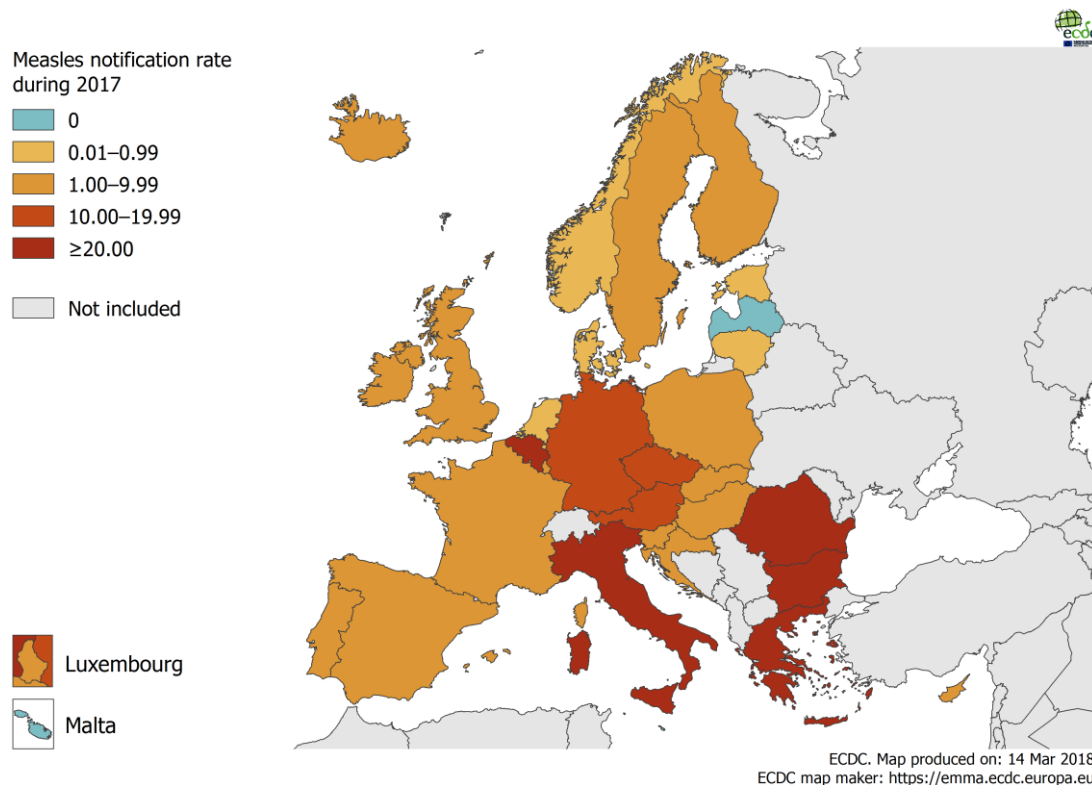
* Notification rates calculated using the most recent population estimates available from Eurostat (2017).

Figure 3. Distribution of measles cases by country, EU/EEA, 2017 (n=14 600)



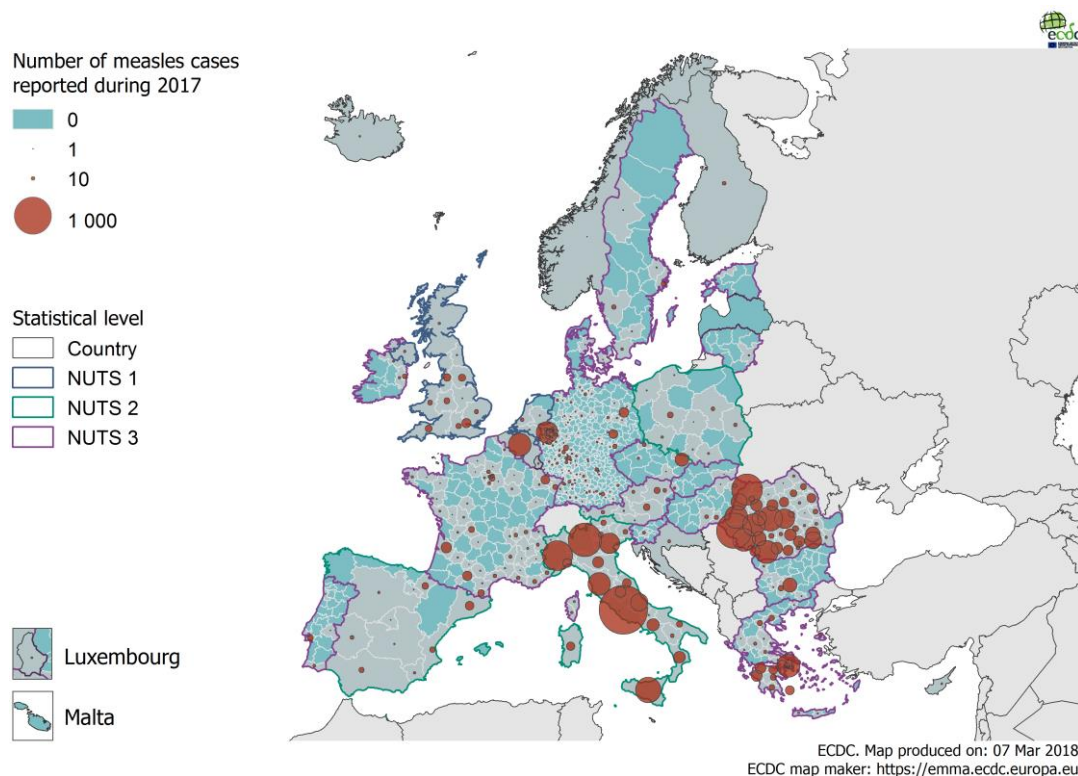
The overall notification rate of measles in 2017 across the EU/EEA was 28.3 cases per million population. During this period, Romania (283.8), Greece (89.7), Italy (84.0) and Belgium (32.5) had the highest notification rates (Table 1, Figure 4).

Figure 4. Measles cases per million population by country, EU/EEA, 2017



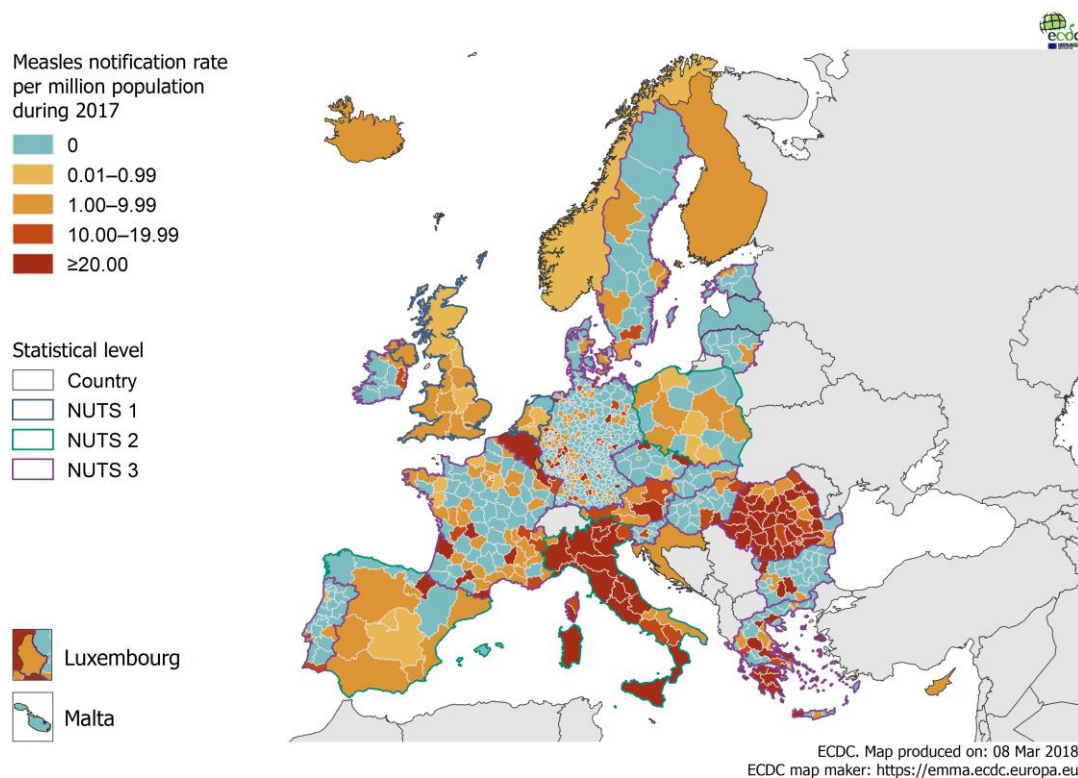
The subnational distribution of cases and notification rates per million population by place of notification presented in Figures 5 and 6 respectively, demonstrate heterogeneous transmission of measles within countries.

Figure 5. Subnational distribution of measles cases by place of notification*, EU/EEA, 2017 (n=14 600)



**For Denmark, subnational data is based on place of residence. For Belgium, Croatia, Cyprus, Finland, Iceland, Luxembourg and Norway, the number of cases by country are presented, as reported in TESSy.*

Figure 6. Subnational distribution of measles cases per million population by place of notification*, EU/EEA, 2017

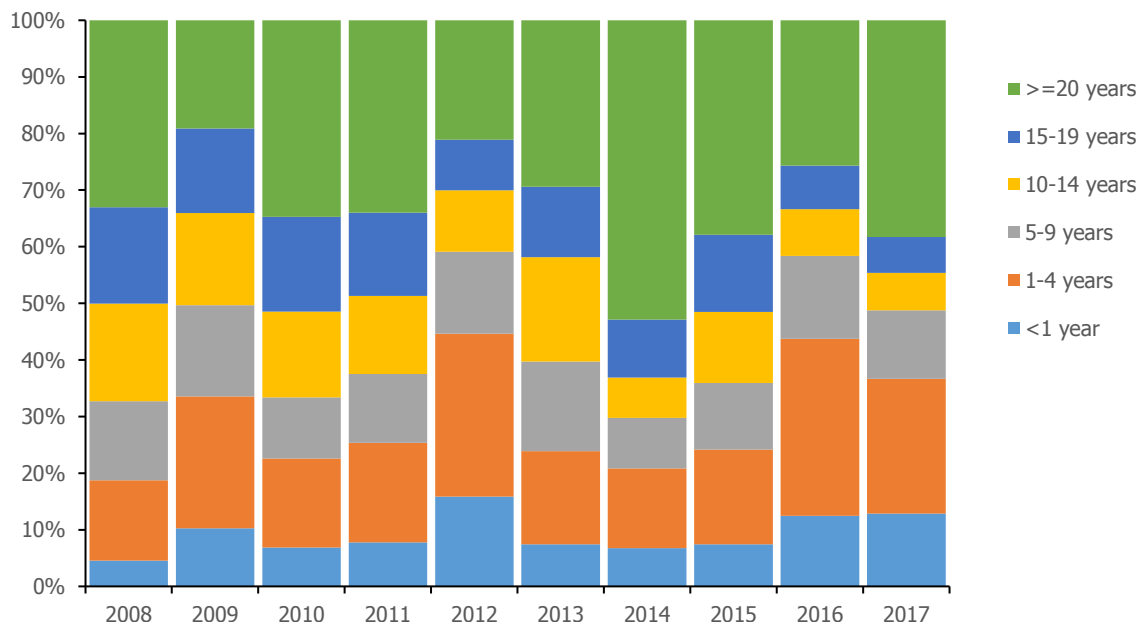


**For Denmark, subnational data is based on place of residence. For Belgium, Croatia, Cyprus, Finland, Iceland, Luxembourg and Norway, the notification rates by country are presented, as reported in TESSy.*

Among 13 716 cases for which the origin of infection was known, 12 160 (89%) were reported to be endemic, 1 173 (9%) import-related and 383 (3%) imported. Cases were classified as imported if there was virological and/or epidemiological evidence of exposure outside the region or country 7–18 days prior to rash onset; and as import-related if they were locally-acquired infections caused by imported virus, as supported by epidemiological and/or virological evidence.

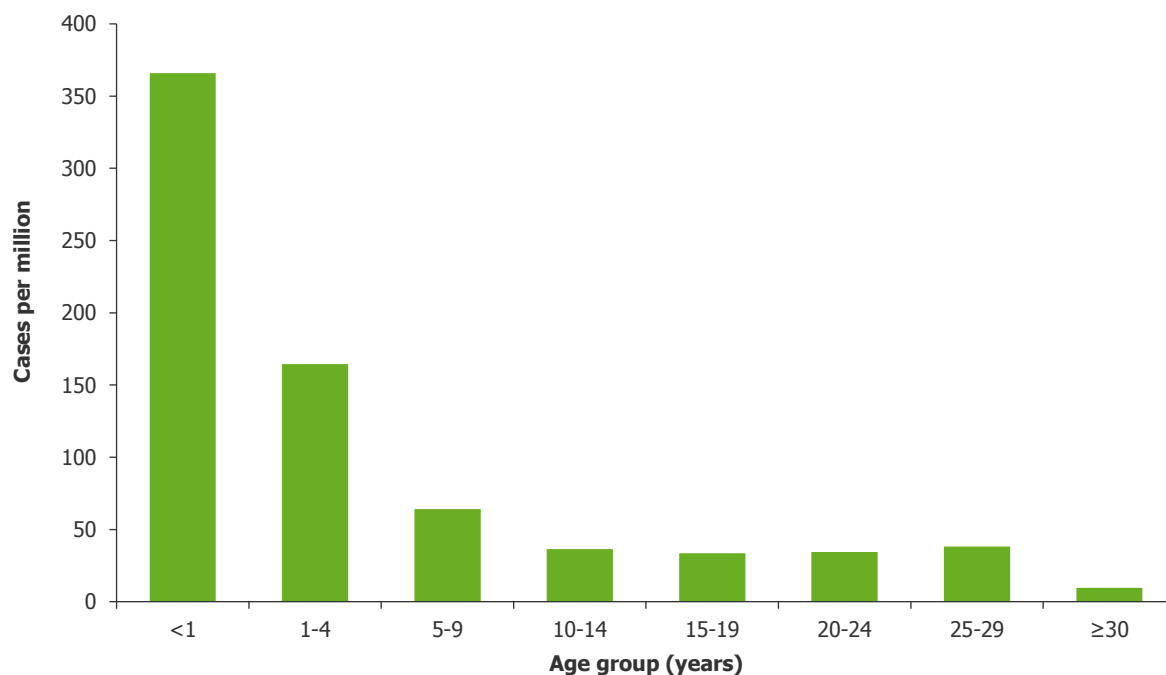
Of 14 600 cases reported in 2017 for which information on age was available, 5 590 (38%) were aged ≥ 20 years and 5 350 (37%) were children < 5 years of age. Figure 7 shows the proportion of cases by age group for the period 2008–2017.

Figure 7. Distribution of measles cases by age group and year, EU/EEA*, 2008–2017



* Between 2008 and 2012, 29 EU/EEA countries reported measles data to TESSy. Since Croatia's accession to the EU in 2013, 30 EU/EEA countries have been reporting measles data to TESSy. Data presented include retrospectively added data from Croatia from 2011 onwards. An estimated 2 239 cases from Romania not yet reported to TESSy for the period from June to December 2017 were not included in the data.

Figure 8 presents the measles notification rates by age group for the EU/EEA in 2017. Over the 12 month period, the highest incidences were reported in children below one year of age (365.9 cases per million) and children aged 1 to 4 years (164.4 cases per million). These age groups have consistently had the highest age-specific notification rates in the past 10 years.

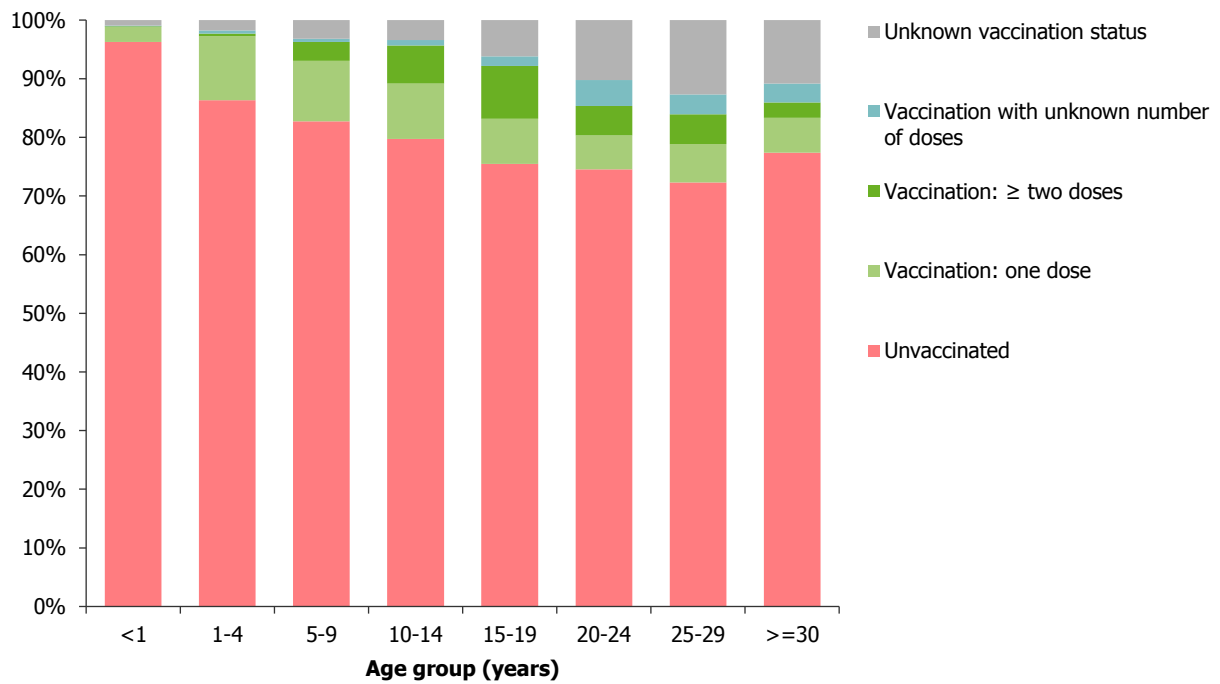
Figure 8. Measles notification rate by age group, EU/EEA, 2017, (n=14 600 cases with known age)

Of the 13 753 cases for whom vaccination status was known, 87% were unvaccinated, 8% were vaccinated with one dose of measles-containing vaccine, 3% were vaccinated with two or more doses, and 2% were vaccinated with an unknown number of doses. Of all cases, 6% had an unknown vaccination status. The proportion of cases with unknown vaccination status was highest in adults aged 25–29 years, reaching 13%.

The proportion of unvaccinated cases was high across all age groups (Figure 9), but highest among children below one year of age (96%), who are too young to have received the first dose of the measles-containing vaccine. Infants below the age of one year are particularly vulnerable to complications of measles and are best protected by herd immunity, which is achieved when population coverage for the second dose of a measles-containing vaccine is at least 95%.

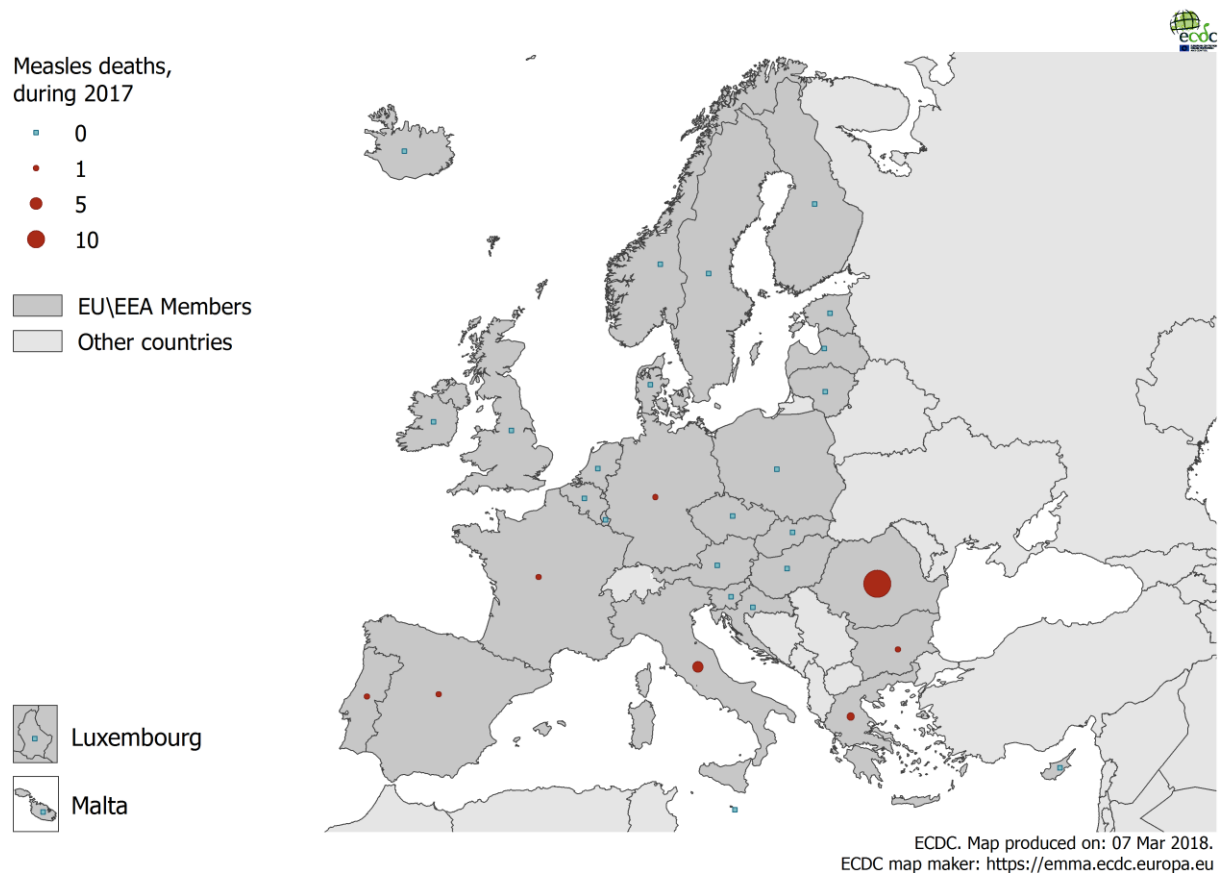
Among cases aged one to four years, 86% of the cases were unvaccinated, 11% were vaccinated with one dose, 0% with two doses or more, 1% with an unknown number of doses and 2% had an unknown vaccination status.

Figure 9. Distribution of measles cases by vaccination status and age group, EU/EEA, 2017 (n=14 600 cases with known age)



In 2017, 37 deaths attributable to measles, were reported by eight countries: 26 in Romania, four in Italy, two in Greece, and one each in Bulgaria, France, Germany, Portugal and Spain (Figure 10) [16].

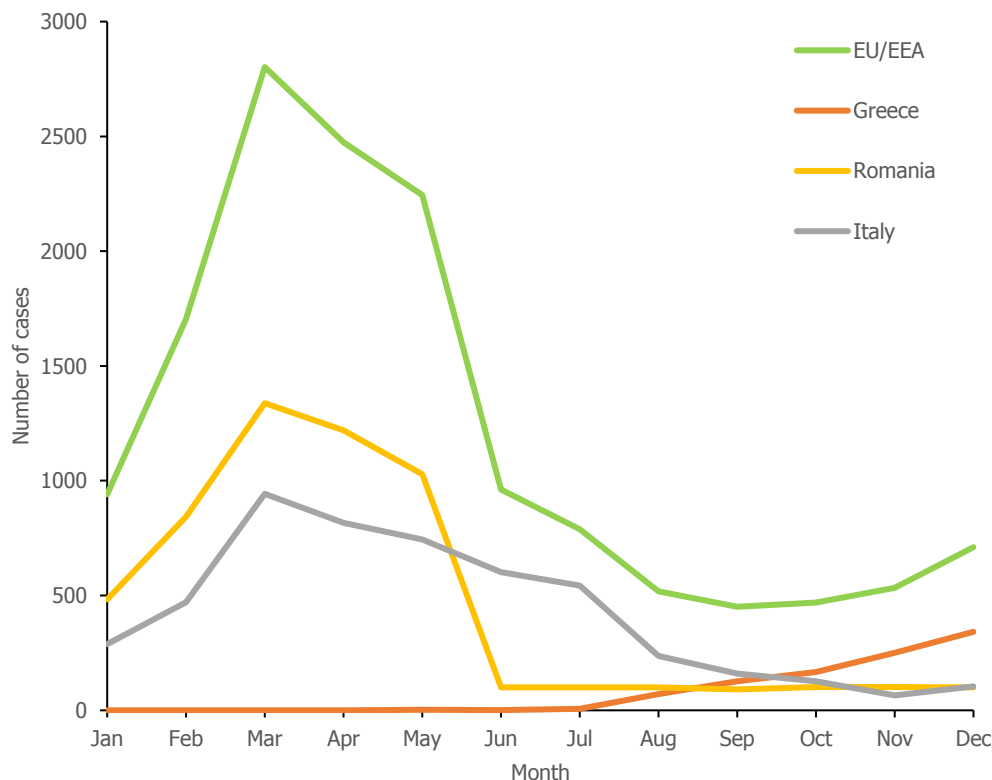
Figure 10. Distribution of measles deaths by country, EU/EEA, 2017 (n=37)



Epidemiological overview of selected countries

Romania (5 608), Italy (5 098), Greece (967) and Germany (929) reported the highest number of measles cases for 2017, accounting respectively for 38%, 35%, 7% and 6% of the 14 600 reported cases. The countries with the highest notification rates were Romania (283.8 cases per million), Greece (89.7), Italy (84.0) and Belgium (32.5).

Figure 11. Distribution of measles cases by month, Greece, Italy, Romania* and EU/EEA, 2017

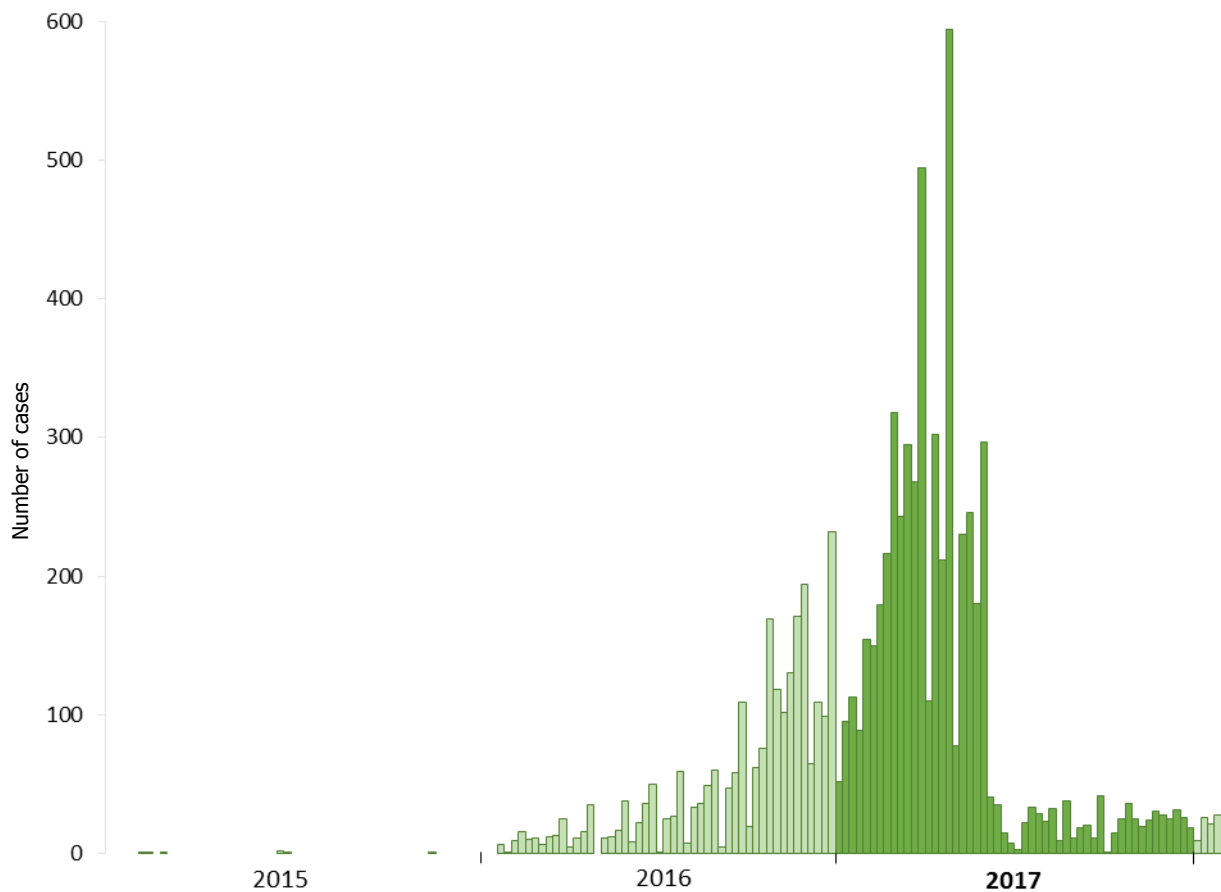


* An estimated 2 239 cases from Romania not yet reported to TESSy for the period from June to December 2017 are not included in the data.

Romania

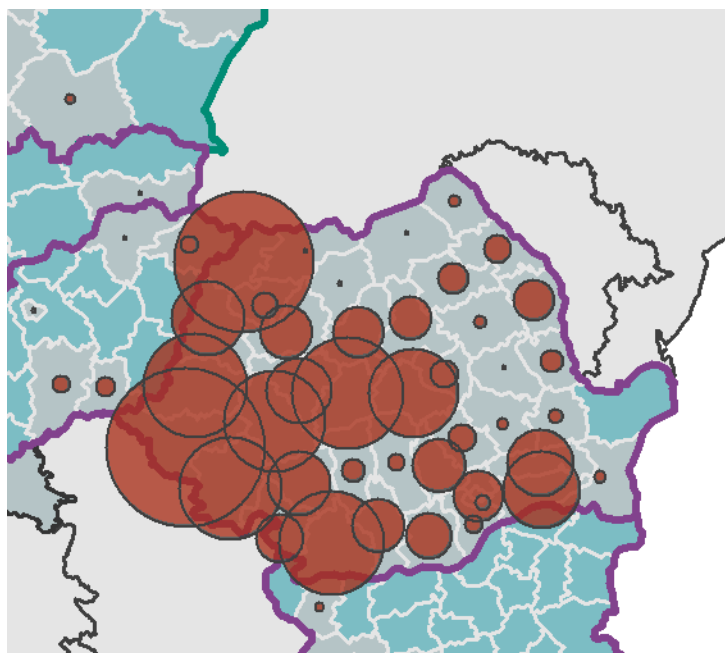
Owing to reporting delay caused by the sustained outbreak in the country since 2016, the total 5 608 cases reported by Romania for 2017 was short by an estimated 2 239 cases for the period June–December 2017 not yet submitted to TESSy (Figures 11 and 12) [15]. ECDC previously published a rapid risk assessment on the outbreak in Romania [6], and the Romanian National Institute of Public health registered a total 10 279 confirmed cases and 37 deaths between January 2016 and 29 December 2017 [15]. The main circulating genotype was B3.

Figure 12. Distribution of measles cases by week, Romania*, 2015–2018



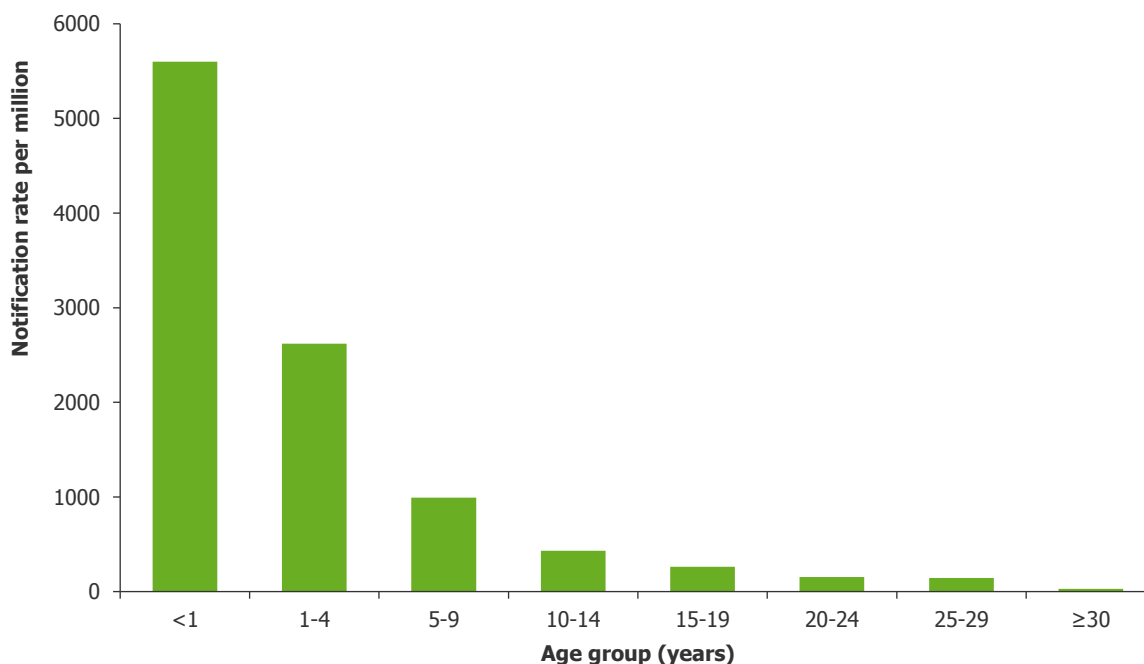
* Estimated 2 239 cases from Romania not yet reported to TESSy for the period from June to December 2017 are not included in the data.

Figure 13. Subnational distribution of measles cases by place of notification, Romania, 2017 (n=5 608)



Young children were the most affected, with 55% of the 5 608 cases reported to TESSy for 2017 aged under 5 years. The highest notification rates were also observed in children aged less than five years (Figure 14). This follows a similar pattern to that of previous large outbreaks (2005–2006 and 2010–2014) [6].

Figure 14. Measles notification rate by age group, Romania, 2017 (n= 5 608 with known age)



The vaccination coverage for measles-containing vaccine in Romania, as submitted to WHO for 2016, was 86% and 76% for the first and second doses, respectively [17,18]. The 2016 outbreak continued into 2017 despite reinforced vaccination interventions implemented during the course of the outbreak [6]. The chronological evolution of measles vaccination policies in Romania is as follows:

- 1979: monovalent measles vaccine was introduced for children aged 9–11 months.
- 1994: the second dose of measles-containing vaccine was introduced for children aged 6–7 years.
- 2004: measles mumps and rubella (MMR) vaccine replaced the first dose of monovalent measles vaccine, and was recommended for children aged 12–15 months. The second dose of MMR vaccine was recommended for children aged 6–7 years from October 2005 as part of school-based vaccination.
- 2015: the second dose of MMR was moved down in the vaccination schedule to five years of age and vaccination now occurs in health centres rather than being school-based.

Italy

Following a period of relatively fewer cases of measles in 2015 and 2016, with 255 and 861 cases, respectively, case counts increased rapidly from the beginning of 2017. The number of reported cases remained high until June, but the peak of the outbreak was recorded in March (943 cases) (Figures 11 and 15). For 2017, Italy reported a total of 5 098 cases and four deaths. The main circulating genotypes reported were B3 and D8.

Figure 15. Distribution of measles cases by week, Italy, 2015–2018

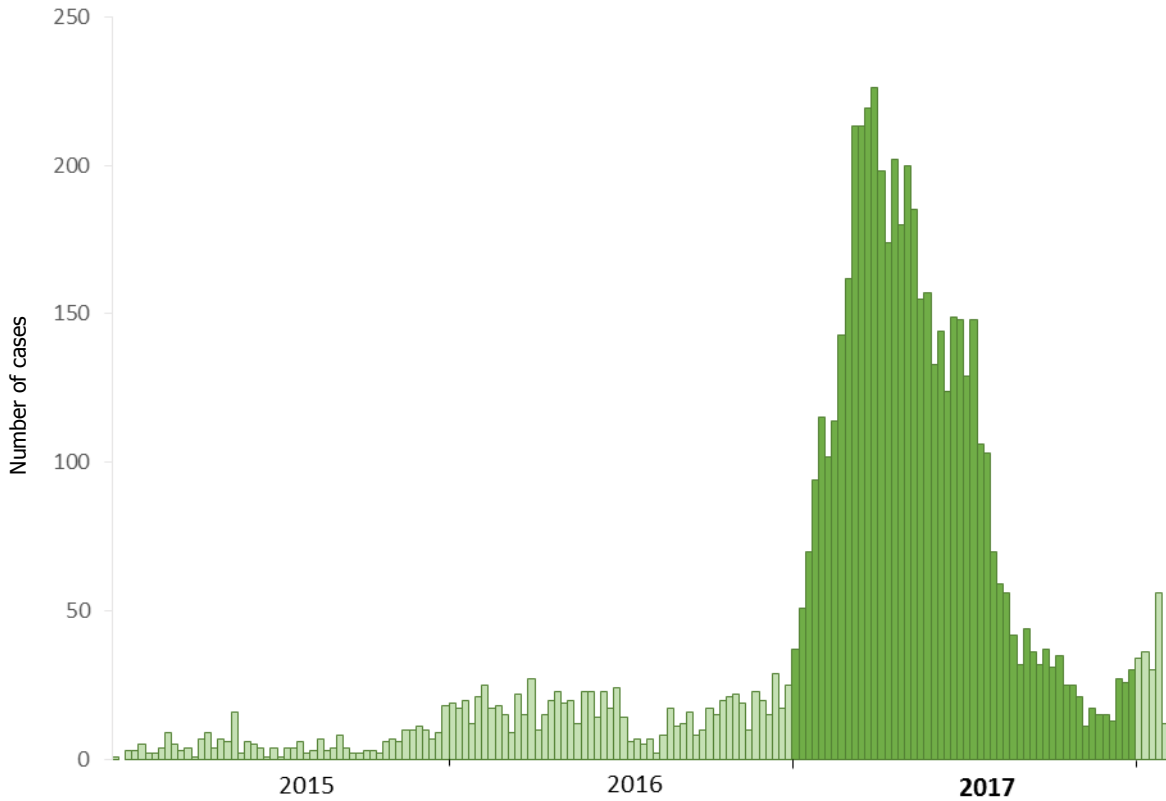
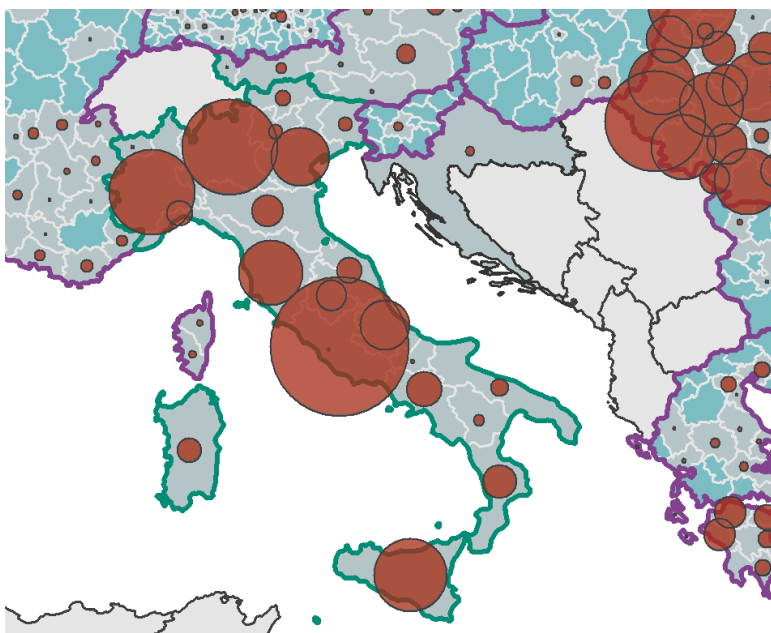
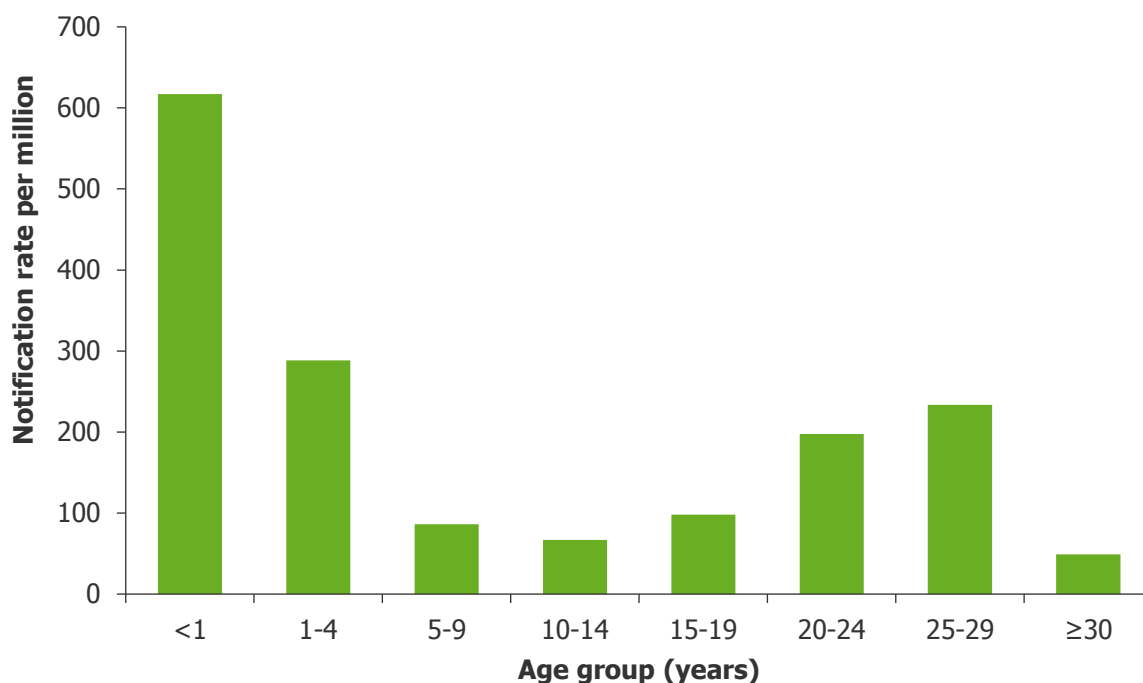


Figure 16. Subnational distribution of measles cases by place of notification, Italy, 2017 (n=5 608)



Most cases were in adults, with 68% of reported cases aged above 20 years. However, the highest notification rate was in infants below one year of age (Figure 17). Since the introduction of the measles-containing vaccine in 1976, uptake has remained persistently low in Italy [19]. A large pool of measles-susceptible populations has accumulated, and the vaccination gaps in young adults and adolescents are evident from the constantly increasing age of reported cases in Italy [19].

Figure 17. Measles notification rate by age group, Italy, 2017 (n= 5 098 with known age)



The vaccination coverage for measles-containing vaccine in Italy, as submitted to WHO for 2016, was respectively 85% and 83% for the first and second dose [17,18]. The vaccination coverage for both the first and second doses have continued to decline in Italy since their peak in 2013.

Greece

Greece reported no cases of measles in 2016 and only one case in both 2014 and 2015. The first cases of measles since September 2015 were reported in May 2017, and case counts increased sharply for the rest of the year (Figures 11 and 18). The main circulating genotype was B3.

Figure 18. Distribution of measles cases by week, Greece, 2015–2018

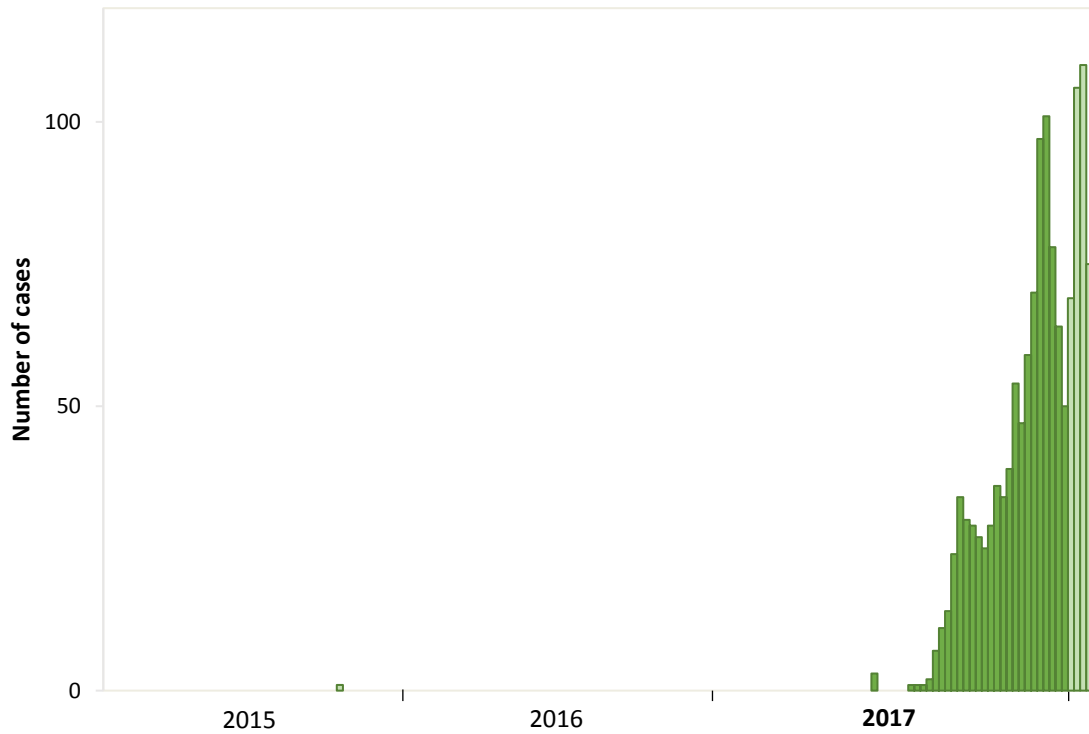
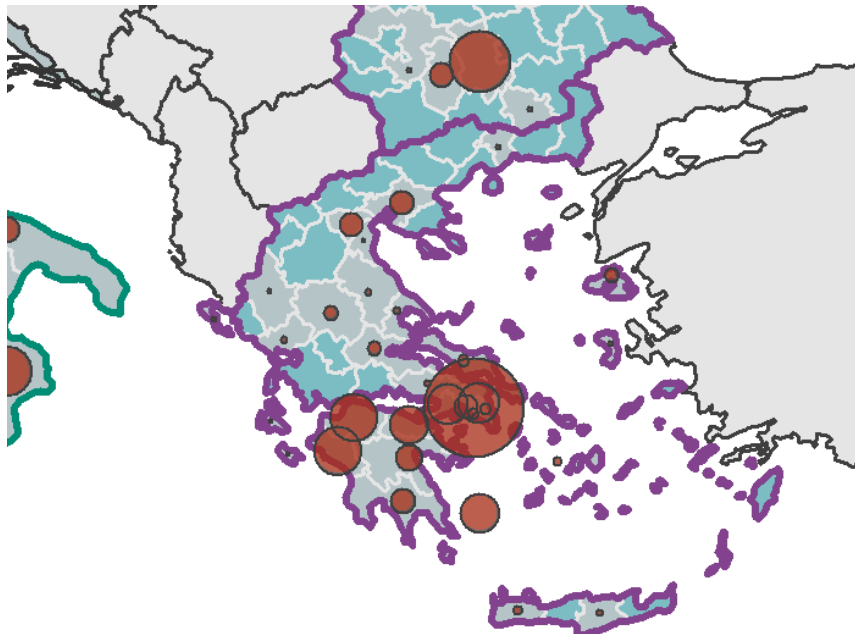
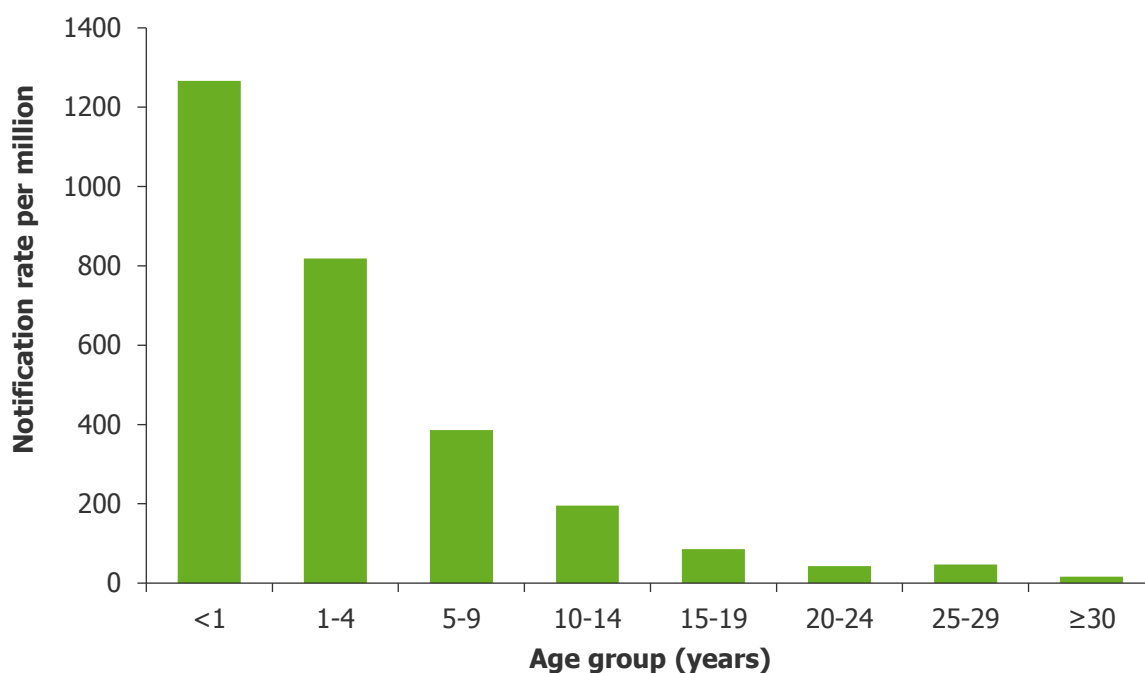


Figure 19. Subnational distribution of measles cases by place of notification, Greece, 2017 (n=967)



Children aged less than five years accounted for 45% (434) of the total 967 cases, and notification rates were also highest in this age group (Figure 20). About 70% of cases occurred in Greek nationals of Roma origin, who were mainly children, while adults accounted for almost two thirds of cases in the general population [20]. The demographic distribution of cases further indicates pockets of susceptible groups in the Greek population.

Figure 20. Measles notification rate by age group, Greece, 2017 (n= 967 with known age)



The vaccination coverage for measles-containing vaccine in Greece, as submitted to WHO for 2016, was 97% and 83% for respectively the first and second dose [17,18]. In response to the outbreak situation, Greece lowered the age of administration of the second dose of the measles-containing vaccine to the second year of life (instead of between 4-6 years of age).

Rubella

Methods

Twenty-eight EU/EEA countries report rubella data to TESSy on a monthly basis. All countries report case-based data in line with the 2012 EU case definitions [14], except Poland, which reports aggregated data.

The current surveillance system in Denmark reports rubella infections during pregnancy only, and the incidence of rubella in the Danish population may be underestimated.

Belgium operates a network of sentinel laboratories (58% coverage) that voluntarily reports cases positive for IgM to the Institute of Public Health. In France, a surveillance system captures rubella infections diagnosed in pregnant women or newborn infants [6]. In the absence of comprehensive national surveillance systems for rubella, the two Member States do not report data to TESSy.

This annual report covers rubella surveillance data for 2017, retrieved from TESSy on 28 February 2018.

Epidemiology

In 2017, eleven EU/EEA countries reported 696 rubella cases to TESSy (Table 2). This was a decrease from 1 264 and 2 161 cases reported in 2016 and 2015, respectively. The diagnosis was confirmed by positive laboratory results (serology, virus detection or isolation) in 97 reported cases (14%).

The highest number of cases were reported by Poland (496), Germany (73), Italy (67) and Austria (39) accounting for 71%, 10%, 10% and 6% of reported cases, respectively. Seventeen countries reported zero cases. The distribution of cases and the notification rates by country for 2017 are presented in Figures 21 and 22.

Table 2. Distribution of rubella cases, EU/EEA, 2017

Country	2017												Total cases	Cases per million	Total lab-positive cases
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Austria	0	0	24	1	1	0	0	0	0	1	7	5	39	4.49	36
Bulgaria	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
Croatia	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
Cyprus	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
Czech Republic	0	0	0	1	1	0	0	0	0	0	0	0	2	0.19	2
Denmark	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
Estonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
Finland	0	0	0	0	0	0	0	0	0	1	0	0	1	0.18	1
Germany	5	5	8	7	9	9	6	4	4	9	4	3	73	0.89	11
Greece	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
Hungary	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
Iceland	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
Ireland	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
Italy	3	8	15	11	12	6	2	1	3	2	2	2	67	1.10	31
Latvia	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
Lithuania	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
Luxembourg	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
Norway	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
Poland	49	39	44	43	57	45	44	37	31	40	34	33	496	13.06	6
Portugal	0	1	1	0	0	0	0	0	2	0	0	0	4	0.39	0
Romania	1	1	0	1	2	0	1	2	0	0	1	0	9	0.46	6
Slovakia	0	0	0	1	0	0	0	0	0	0	0	0	1	0.18	0
Slovenia	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
Spain	0	0	0	0	0	0	1	0	0	0	0	0	1	0.02	1
Sweden	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
United Kingdom	0	0	0	1	0	0	0	0	0	1	1	0	3	0.05	3
EU/EEA	58	54	92	66	82	60	54	44	40	54	49	43	696	1.60	97

* Notification rates calculated using the most recent population estimates available from Eurostat (2017).

Figure 21. Distribution of rubella cases by country, EU/EEA, 2017 (n = 696)

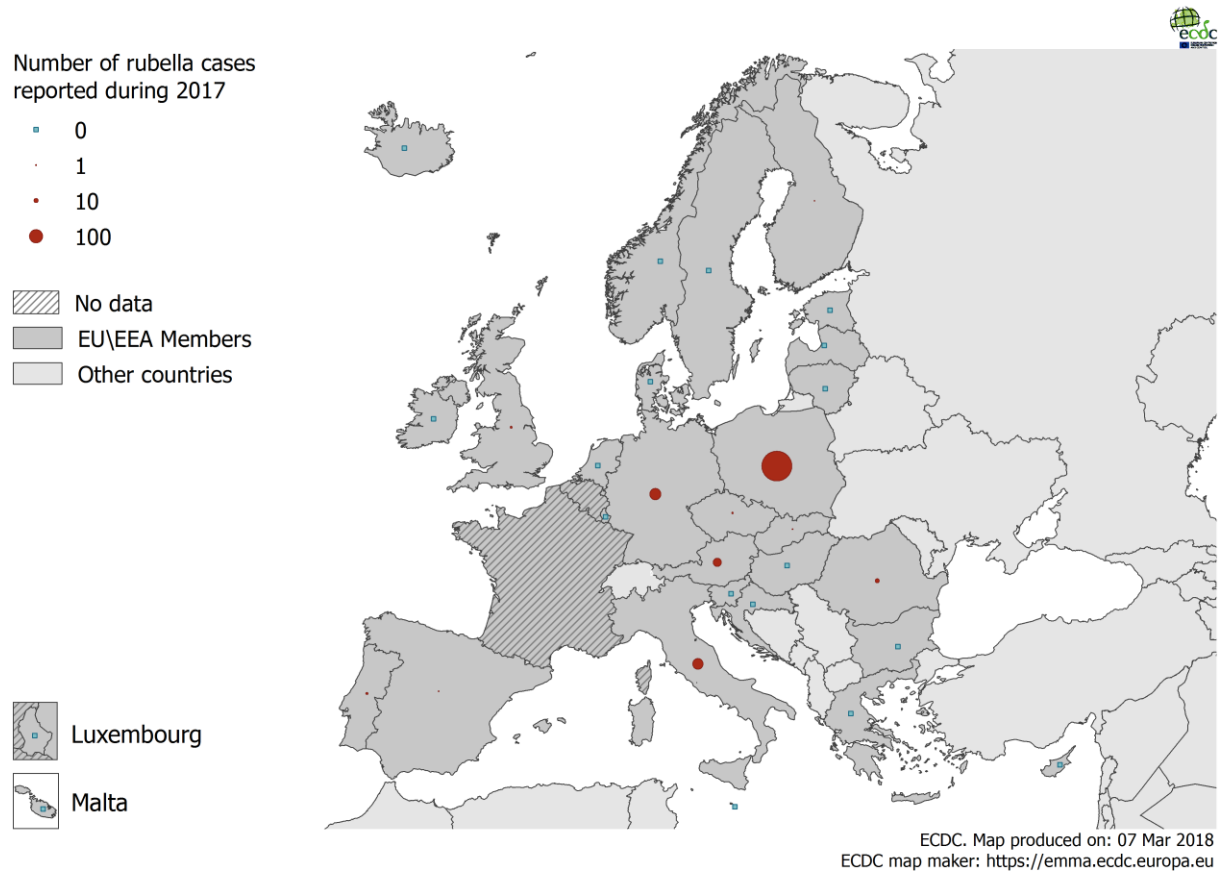
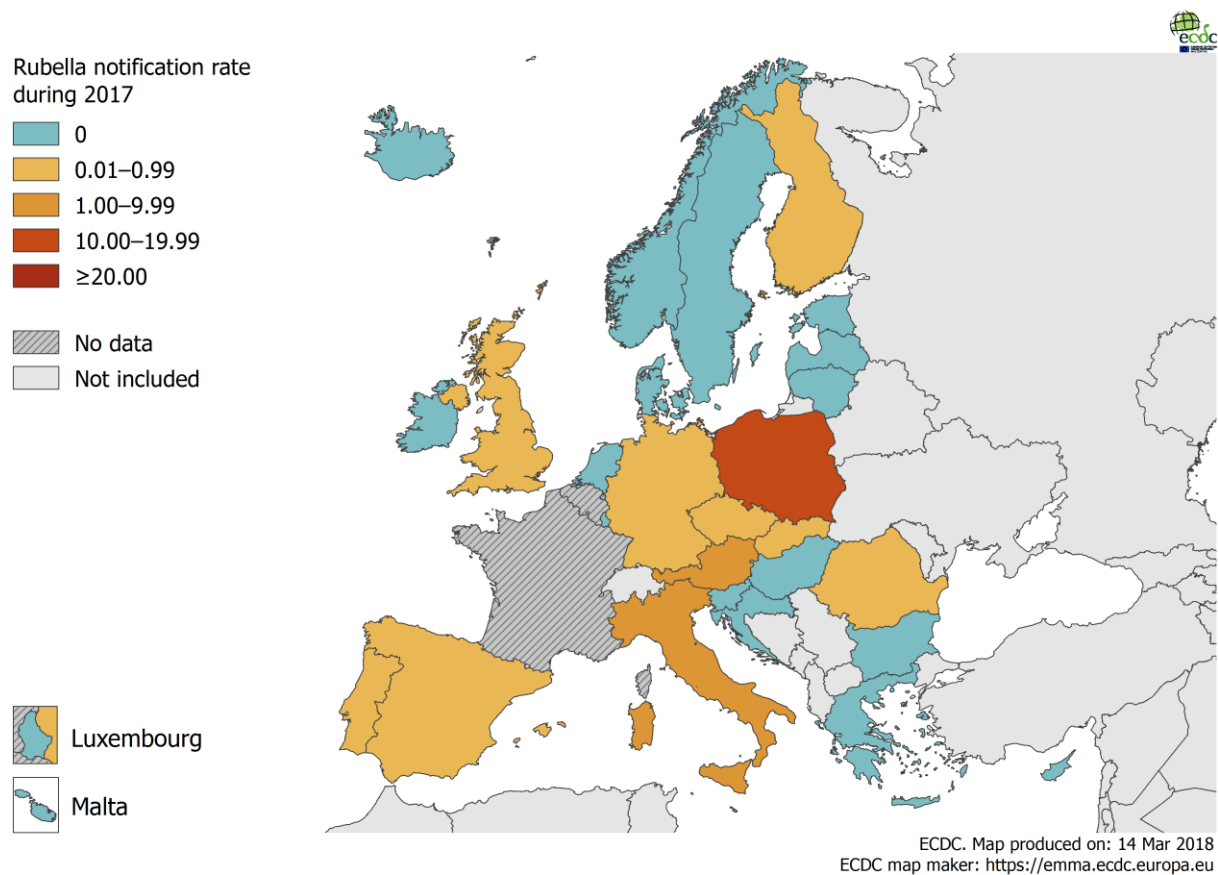
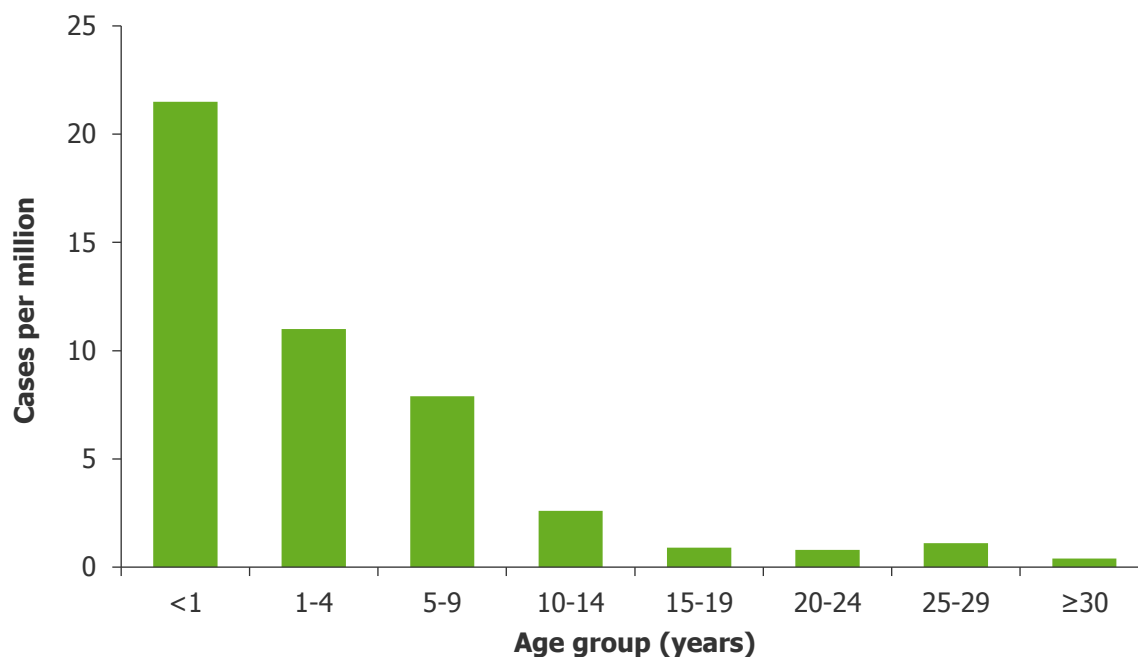


Figure 22. Rubella cases per million population by country, EU/EEA, 2017



The highest number of cases were aged 1–4-year-old (192) and 5–9-year-old (180), while the highest age-specific notification rates were observed in infants under one year of age (21.5 cases per million population) and in cases aged between one and four years (11 cases per million population) (Figure 23).

Figure 23. Rubella notification rate by age group, EU/EEA, 2017 (n= 696 cases with known age)



Overall, Poland accounted for 71% all reported rubella cases and had the highest incidence in the 12 months period (30.1 cases per million) (Table 2). However, only six cases (1%) were laboratory confirmed. Children were the most affected, 47% were aged less than five years of age and 29% five to nine years. For 2017 in Poland, 180 cases (36%) were unvaccinated, 217 (44%) cases were vaccinated with one dose, 50 (10%) cases had received two or more doses, and 49 (10%) cases had an unknown vaccination status.

Progress towards measles and rubella elimination in the EU/EEA

The WHO Regional Committee for Europe adopted the goal of eliminating measles transmission in 1998, and in 2005 expanded this commitment to include rubella, with the aim of eliminating both diseases by 2010 [21]. Despite significant progress towards this goal, the next target date of elimination by 2015 was missed and the elimination of measles and rubella in the region is yet to be achieved.

Measles/rubella elimination is defined as the absence of endemic cases in a defined geographical area with a well-performing surveillance system for at least 36 months [22].

The Regional Verification Commission for Measles and Rubella Elimination (RVC) monitors progress towards elimination of measles and rubella in the WHO European Region. The RVC annually reviews data from the preceding calendar on the epidemiological situation, molecular epidemiology, surveillance performance, population immunity, and the sustainability of the national immunisation programmes; as submitted by National Verification Committees within Member States [22].

At the sixth meeting of the RVC in June 2017, 33 (22 of which are in EU/EEA) countries in the WHO European region were declared to have reached the elimination goal for measles. Additionally, four EU/EEA countries were assessed to have interrupted endemic transmission for less than 36 months. Four EU/EEA countries: Belgium, France, Italy and Romania were judged to still have endemic transmission of measles [23] (Table 3).

Table 3. Measles elimination status of EU/EEA Member States, based on 2016 data review by the Regional Verification Commission meeting in June 2017.

Elimination status	Country
EU/EEA Member States judged to have eliminated the disease (≥ 36 months without endemic transmission)	Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, Iceland, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Portugal, Slovakia, Slovenia, Spain, Sweden, the United Kingdom
EU/EEA Member States judged to have interrupted endemic transmission for 24 months	Ireland
EU/EEA Member States judged to have interrupted endemic transmission for 12 months	Austria, Germany, Poland
EU/EEA Member States judged to have endemic transmission	Belgium, France, Italy, Romania

At the same meeting, 37 (of which 21 are in EU/EEA) countries in the WHO European region were declared to have eliminated endemic rubella transmission. Additionally, two EU/EEA countries had interrupted endemic transmission for less than 36 months and seven EU/EEA countries were still endemic for rubella transmission [23] (Table 4).

Table 4. Rubella elimination status of EU/EEA Member States, based on 2016 data review by the Regional Verification Commission meeting in June 2017.

Elimination status	Country
EU/EEA Member States judged to have eliminated the disease (≥ 36 months without endemic transmission)	Croatia, Cyprus, the Czech Republic, Estonia, Finland, Greece, Hungary, Iceland, Ireland, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Portugal, Slovakia, Slovenia, Spain, Sweden, the United Kingdom
EU/EEA Member States judged to have interrupted endemic transmission for 24 months	Austria
EU/EEA Member States judged to have interrupted endemic transmission for 12 months	Bulgaria
EU/EEA Member States judged to have endemic transmission	Belgium, Denmark, France, Germany, Italy, Poland, Romania

Vaccination coverage as a proxy for population immunity and incidence as a proxy for disease control, are indicators used to monitor progress towards measles and rubella elimination. Incidence measures, however, are only reliable when the quality of surveillance systems is high and outbreaks are thoroughly investigated [22].

Tables 5 and 6 present progress indicators on the elimination status of measles and rubella; as well as selected surveillance performance indicators, by country; based on vaccination coverage reports submitted to WHO for 2016 [17,18,24] and 2017 data from TESSy.

Table 5. Selected indicators for monitoring progress towards measles elimination*, EU/EEA, 2017.

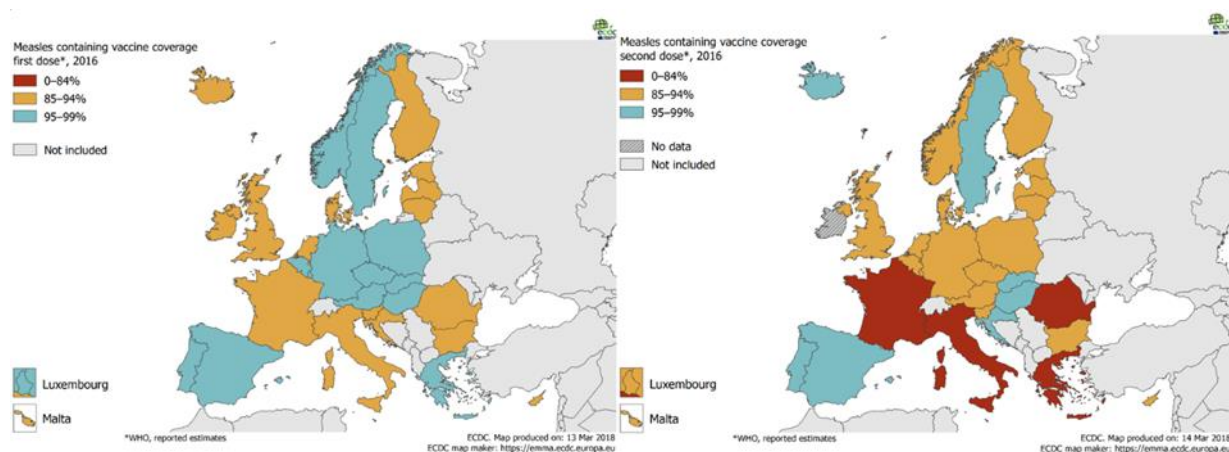
Country	Vaccination coverage ¹ (%)		Incidence of endemic cases ² per 1 000 000	Surveillance performance indicators			
	First dose	Second dose		Timeliness of monthly reporting, (%)	Completeness of reporting as of 28/02/2018, (%)	Rate of discarded cases per 100 000	Origin of infection identified, (%)
Target**	≥95	≥95	<1	≥80	-	≥2	≥80
Austria	95	89	9.7	100	100	0.6	98.9
Belgium	96	85	-	83.3	100	4.0	-
Bulgaria	92	88	23.1	91.7	100	0	82.5
Croatia	90	96	1.7	75	100	0.1	71.4
Cyprus	90	88	1.2	100	100	0	100
Czech Republic	98	93	13.5	91.7	100	0	100
Denmark	94	85	0.4	100	100	0	100
Estonia	93	92	0	100	100	3.0	100
Finland	94	85	0.7	91.7	100	0	80.0
France	90	79	7.3	100	100	0	90.2
Germany	97	93	10.5	91.7	100	0	87.2
Greece	97	83	89.4	100	100	0.5	99.2
Hungary	99	99	3.2	75.0	100	0.4	100
Iceland	91	95	3.0	91.7	100	0	100
Ireland	92	-	5.3	100	100	0	92.0
Italy	85	83	83.3	91.7	100	0.6	94.1
Latvia	93	89	0	100	100	0	-
Lithuania	94	92	0	91.7	100	0	100
Luxembourg	99	86	1.7	100	100	0	100
Malta	93	86	0	100	100	0	-
Netherlands	94	91	0.6	91.7	100	0	100
Norway	96	91	0	100	100	0	100
Poland	96	94	1.4	100	100	0	100
Portugal	98	95	3.1	91.7	100	2.2	100
Romania	86	76	282.8	100	100	0	100
Slovakia	95	97	0.9	100	100	0.1	100
Slovenia	92	93	2.4	100	100	0	100
Spain	97	95	3.0	75.0	100	0.3	100
Sweden	97	95	3.0	100	100	0.1	100
United Kingdom	92	89	2.3	100	100	0	100
EU/EEA	93.8	86.7	27.5	94.4	100	0.3	93.9

*A selection of surveillance performance indicators that can be readily calculated from TESSy data [22].

** As defined in the Framework for the verification process in the WHO European region [22].

¹2016 national figures reported via the annual WHO/UNICEF Joint Reporting Form.

²Excludes imported cases.

Figure 24. Vaccination coverage for the first (left panel) and second (right panel) doses of measles-containing vaccine by country*, EU/EEA, 2016

* National figures reported via the annual WHO/UNICEF Joint Reporting Form.

The vaccination coverage in 2016 for the second dose of measles-containing vaccine met the elimination target of at least 95% in only seven of 29 EU/EEA countries with data (Table 5, Figure 24). Ireland does not report data on vaccination coverage of the second dose of measles containing vaccine. For the first dose of measles-containing vaccine, 13 of 30 countries with data met the elimination target of at least 95% (Table 3, Figure 24).

The overall incidence of endemic measles in the EU/EEA countries for 2017 was 27.5 cases per million population. Nine countries had an endemic incidence meeting the elimination target of less than one case per million population while 20 had incidences above this threshold (Table 5).

Table 6. Selected indicators for monitoring progress towards rubella elimination*, EU/EEA, 2017.

Country	Vaccination coverage ¹ first dose (%)	Incidence of endemic cases ² per 1 000 000	Surveillance performance indicators			
			Timeliness of monthly reporting (%)	Completeness of reporting (%) as of 28/02/2018	Rate of discarded cases per 100 000	Origin of infection identified (%)
Target**	≥95	<1	≥80	-	≥2	≥80
Austria	95	4.1	91.7	100	0	100
Belgium	96	-	-	-	-	-
Bulgaria	92	0	100	100	0	-
Croatia	90	0	66.7	100	0	-
Cyprus	90	0	100	100	0	-
Czech Republic	98	0.1	83.3	100	0	100
Denmark	94	0	100	100	0	-
Estonia	93	0	100	100	1.6	-
Finland	94	0.2	91.7	100	0	0.0
France	91	-	-	-	-	-
Germany	97	0.9	91.7	100	0	43.8
Greece	97	0	100	100	0	-
Hungary	99	0	66.7	100	0.1	-
Iceland	91	0	91.7	100	0	-
Ireland	92	0	100	100	0	-
Italy	85	1.1	91.7	100	0	83.6
Latvia	93	0	100	100	0	-
Lithuania	94	0	91.7	100	0	-
Luxembourg	99	0	100	100	0	-
Malta	93	0	100	100	0	-
Netherlands	94	0	83.3	100	0	-
Norway	96	0	100	100	0	-
Poland	96	-	100	100	0	-

Country	Vaccination coverage ¹ first dose (%)	Incidence of endemic cases ² per 1 000 000	Surveillance performance indicators			
			Timeliness of monthly reporting (%)	Completeness of reporting (%) as of 28/02/2018	Rate of discarded cases per 100 000	Origin of infection identified (%)
Portugal	98	0.4	66.7	100	0.1	100
Romania	86	0.5	66.7	100	0	100
Slovakia	95	0.2	100	100	0	100
Slovenia	92	0	100	100	0	-
Spain	97	0	66.7	100	0	100
Sweden	97	0	100	100	0	-
United Kingdom	92	0	100	100	0	100
EU/EEA	93.9	-	85.0	100	0.02	21.1

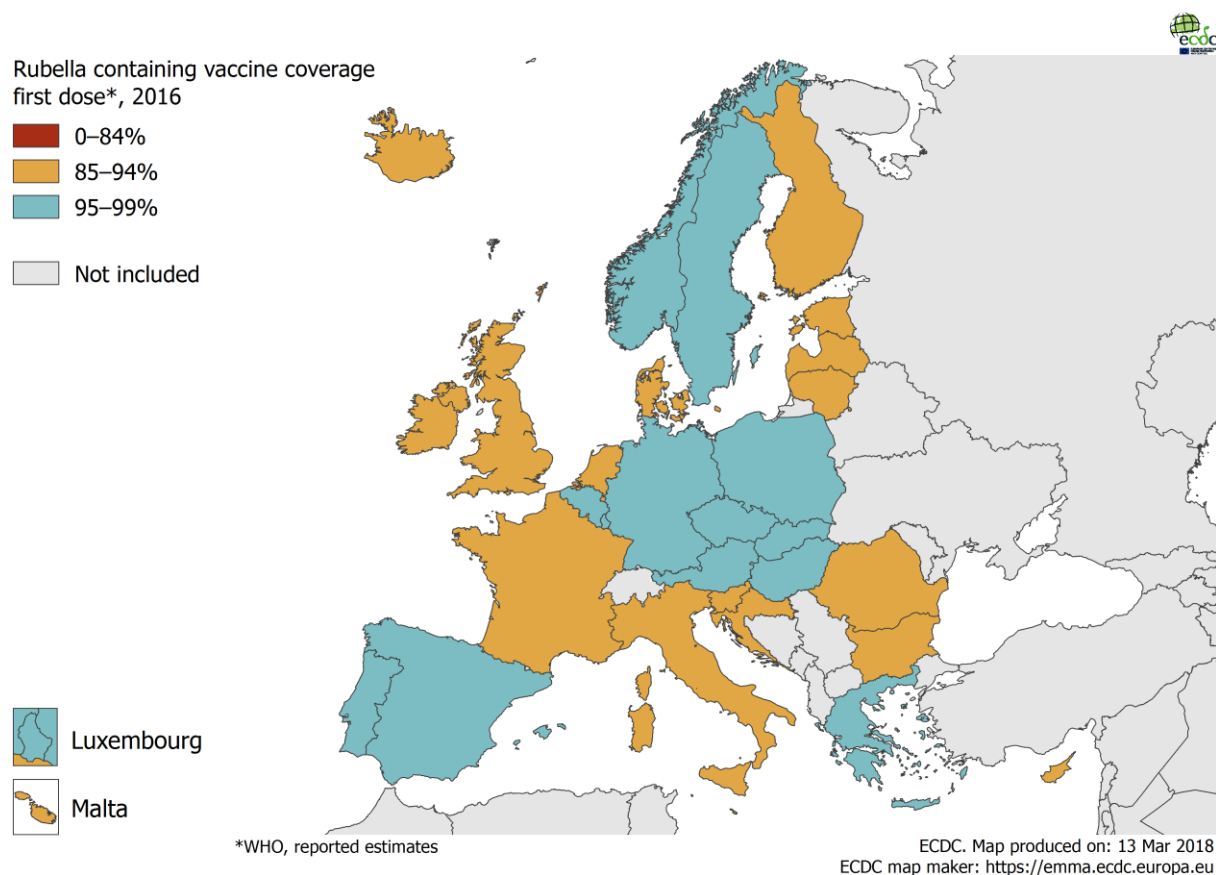
*A selection of surveillance performance indicators that can be readily calculated from TESSy data [22].

** As defined in the Framework for the verification process in the WHO European region [22].

¹2016 national figures reported via the annual WHO/UNICEF Joint Reporting Form.

²Excludes imported cases.

Figure 24. Vaccination coverage for the first dose of rubella-containing vaccine by country*, 2016, EU/EEA countries



* National figures reported via the annual WHO/UNICEF Joint Reporting Form.

In 13 of 30 EU/EEA countries with data, the vaccination coverage for the first dose of rubella-containing vaccine was at least 95% (Table 6, Figure 24). Twenty-five EU/EEA countries reported less than one endemic case of rubella per million population in 2017 (Table 6) while two countries had incidences above this elimination target. The endemic incidence of Poland, which reported the highest number of cases and hence the overall EU/EEA endemic incidence for 2017 could not be calculated (Table 6).

The epidemiological situation and progress indicators in 2017 suggest sustained, re-established or potential endemic transmission of measles across Member States. To reach the goal of eliminating measles and rubella in the EU/EEA, reinforcement of the four key regional strategies aimed at optimising vaccination coverage and surveillance quality [22] is essential.

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