

## Risk of measles transmission in the EU/EEA

21 March 2018

### Main conclusions and options for response

Measles cases in the EU/EEA principally occur in unvaccinated populations in both adults and children. Large outbreaks with fatalities are ongoing in countries that had previously eliminated or interrupted endemic transmission.

Vaccination coverage and occurrence of cases are unequal within countries and demographic groups. Even if a country has an overall coverage rate of 95%, outbreaks can still occur within countries in communities with low coverage rates (i.e. they may be delimited either geographically or socio-demographically).

The high proportion of cases among young adults with unknown vaccination status (13% among 25–29 year-olds), highlights the importance of registration tools, in particular electronic registers to document the vaccination status of individuals. Such registers have the potential to provide timely vaccination coverage data, even at the subnational level, although this is lacking in a number of Member States.

The increasing proportion of cases among adults also highlights the need to consider catch-up campaigns, and Member States are encouraged to identify existing immunity gaps in specific population groups to facilitate supplementary immunisation activities (SIAs).

Lastly, the frequent occurrence of measles among healthcare workers in several EU/EEA countries is a matter of concern and Member States may consider specific interventions such as ensuring all healthcare workers are immune to measles, with proof/documentation of immunity or immunisation as a condition of enrolment into training and employment.

Given the current extent of measles circulation in the EU/EEA, the trend in recent years, and the fact that vaccination coverage for the first and second dose is suboptimal, there is a high risk of continued measles transmission with mutual exportation and importation between EU/EEA Member States and third countries.

### Source and date of request

ECDC Internal Decision, 23 February 2018.

### Public health issue

Risk of further spread and sustained transmission of measles in EU/EEA countries related to ongoing outbreaks and insufficient vaccination coverage.

## Consulted experts

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Experts from the World Health Organization (WHO) Regional Office for Europe contributed to this risk assessment. Although experts from WHO reviewed the risk assessment, the views expressed in this document do not necessarily represent the views of WHO. All experts have submitted declarations of interest and a review of these declarations did not reveal any conflicts of interest.

## Disease background information

Measles is an acute illness caused by *morbillivirus*. The disease is transmitted via airborne respiratory droplets, or by direct contact with nasal and throat secretions of infected individuals. Measles is highly infectious and it is estimated that 90% of non-immune people exposed to an infectious individual will contract the disease.

The main symptoms are fever, rash, cough, runny nose and inflammation of the eye. The first symptoms appear on average 10 days after exposure, but with a range of 7–21 days from exposure to onset of fever. A rash usually appears four days after the symptoms start, and patients are contagious from about four days before until four days after eruption of the rash.

Complications can include pneumonia, encephalitis, otitis media, diarrhoea, laryngotracheo-bronchitis and secondary bacterial infections. Subacute sclerosing panencephalitis (SSPE), a severe but rare and slowly progressing degenerative disease of the central nervous system, characterised by behavioural and intellectual deterioration and seizures may develop six to eight years after primary infection.

Infants, immunocompromised individuals and adults are at higher risk of complications, severe disease and death following measles infection.

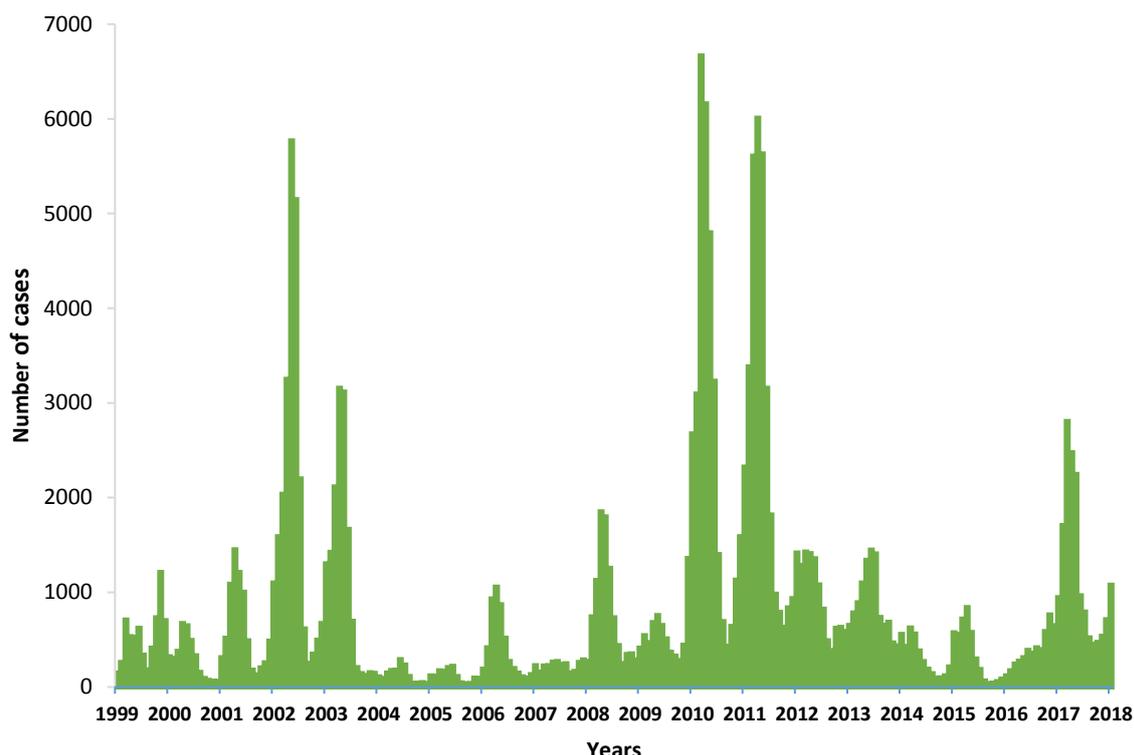
Measles frequently results in widespread outbreaks, mainly among unvaccinated individuals. The disease is preventable by vaccination, which provides lifelong immunity in most recipients. Vaccine uptake of at least 95% with two doses of measles-containing vaccine is necessary to ensure the level of immunity in the population required to interrupt disease circulation and achieve elimination.

For a more complete background of the disease and its epidemiology in the EU, please refer to the ECDC health topic page on measles [1].

## Event background information

Between 1 January 2017 and 31 December 2017, 14 600 cases of measles were reported by EU/EEA Member States to the European surveillance system (TESSy). The total number of cases was more than triple the number of reported cases in 2016 (4 642) and 2015 (4 000). Furthermore, 2 239 cases have been reported by the Romanian Institute of Public Health for 2017 which are not yet submitted to TESSy [2].

**Figure 1. Number of monthly reported measles cases, EU/EEA countries \*, 1999–2018 (n =196 043).**



\* Two peaks of measles in Romania in 2005 (n = 5 647) and in 2006 (n = 3 196) are not included in the graph as Romania joined the EU in 2007. Source: TESSy as of 28 February 2018

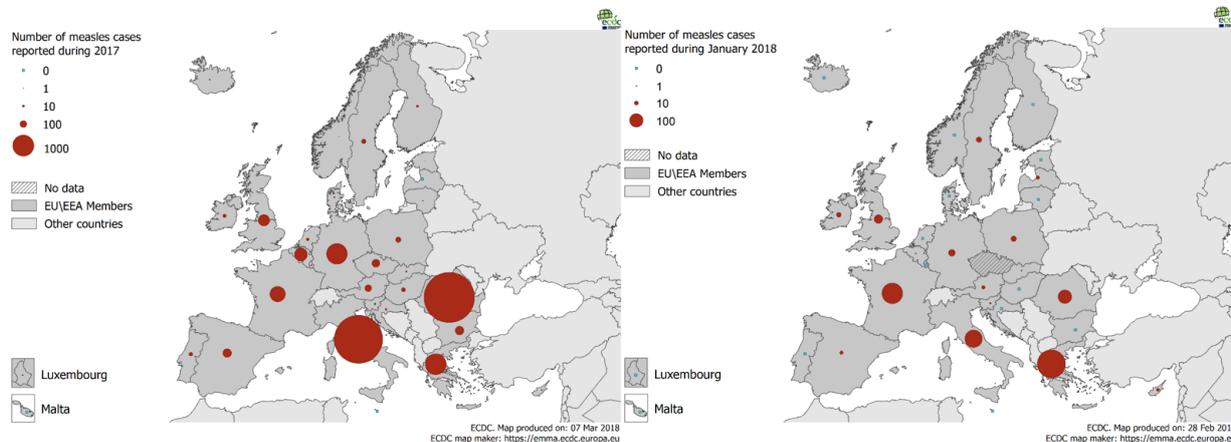
More than 75% of all reported cases in 2017 were recorded in the first half of the year, with the highest numbers in the months of March (2 802), April (2 474) and May (2 244). Following a sharp decline in the number of cases in the summer months, a steady increase was observed towards the end of the year (Figure 1).

The number of cases by country and the subnational notification rate per million population per country for the calendar year 2017 are presented in Figures 2 (left panel) and 3 respectively.

For January 2018, the number of cases (n=1 073) by country is presented in Figure 2 (right panel). All but one (Malta) EU/EEA country reported measles cases in 2017 and January 2018.

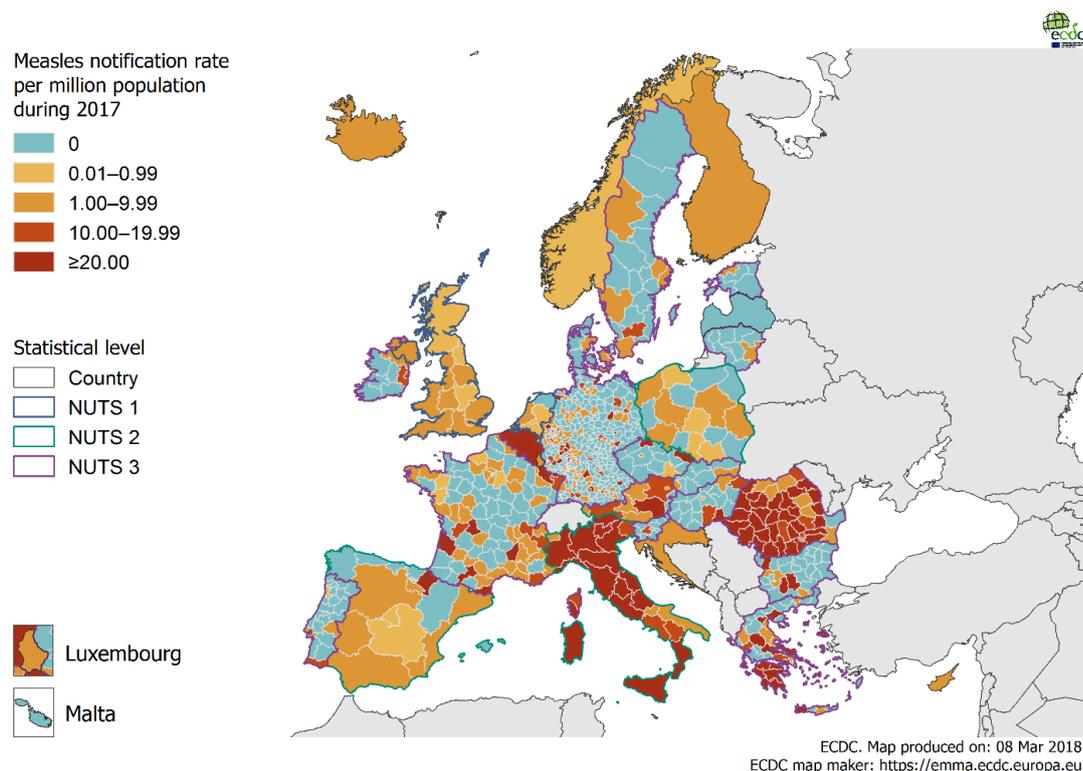
In 2017, most cases were reported by Romania (5 608), Italy (5 098), Greece (967), Germany (929) and France (518), accounting for, respectively 38%, 35%, 7%, 6% and 4% of all cases reported by EU/EEA countries. Since the end of 2017, Greece and France have reported a notable increase in cases.

**Figure 2. Distribution of measles cases by country, EU/EEA, 1 January–31 December 2017 (n=14 600) (left panel) and January 2018 (n=1 073) (right panel)**



The spread of measles cases is not only heterogeneous between countries, but also within countries (Figure 3).

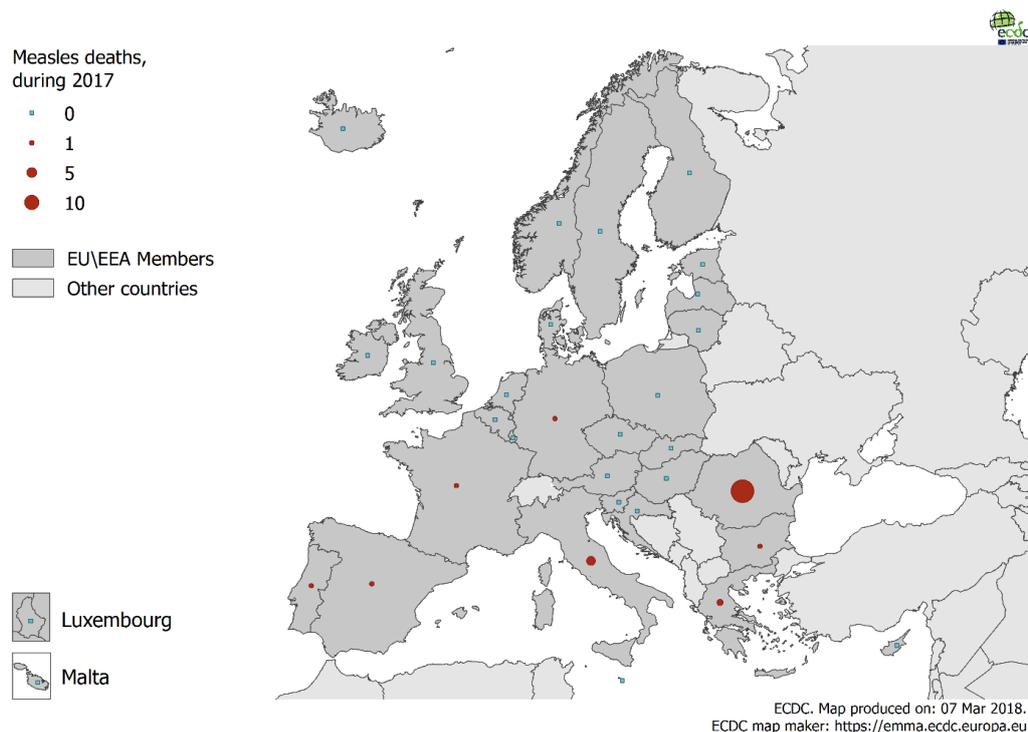
**Figure 3. Subnational distribution of measles cases per million population by place of notification\*, EU/EEA, 1 January 2017–31 December 2017**



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

In 2017, 37 deaths due to measles were reported across the EU/EEA; with 26 in Romania, four in Italy, two in Greece, and one each in Bulgaria, France, Germany, Portugal and Spain [3] (Figure 4). A further seven deaths have been reported in 2018; three in Romania, two in Italy, and one each in Greece and France [4].

**Figure 4. Distribution of measles deaths by country, EU/EEA, 1 January 2017–31 December 2017 (n=37)**



In 2017, among 13 716 cases with known importation status, 12 160 (89%) were reported to be endemic, 1 173 (9%) import-related and 383 (3%) imported.

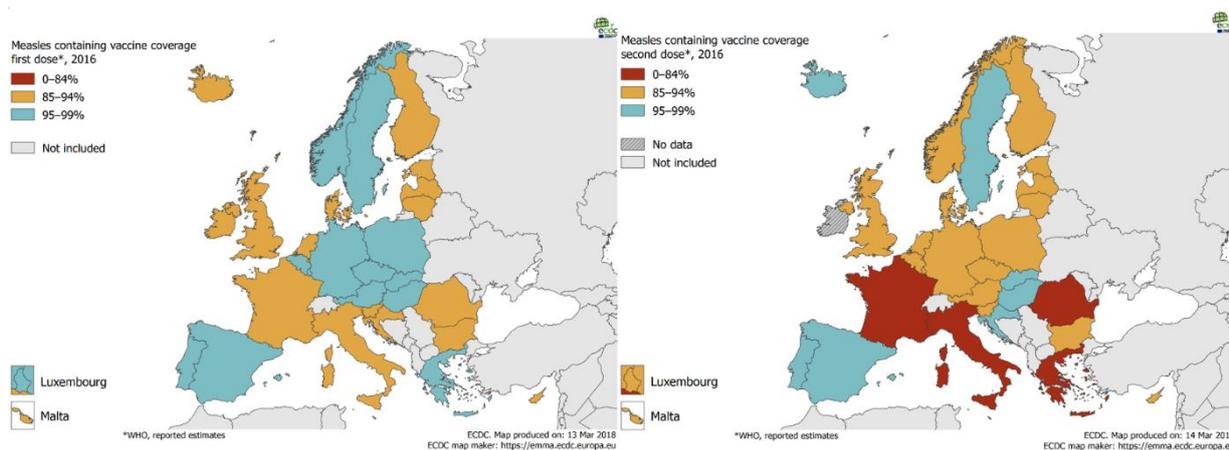
Of 14 600 cases with known age, 5 284 (37%) were in children less than five years of age, while 6 656 (45%) were aged 15 years or older. The highest incidence was reported in children below one year of age (365.9 cases per million), followed by children from 1 to 4 years of age (164.4 cases per million).

Among 13 753 cases with known vaccination status, 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 (13%).

The proportion of unvaccinated cases among the age groups targeted for vaccination ranged from 72% (25–29 year olds) to 86% (1–4 year olds). Among cases below one year of age, the proportion of unvaccinated cases was 96% as most vaccination programmes only target vaccination from one year of age. Infants below the age of one year are particularly vulnerable to complications from measles and are best protected by herd immunity. Herd immunity is achieved when population coverage for the second dose of a measles-containing vaccine is at least 95%.

Measles continues to spread across Europe as the vaccination coverage in many EU/EEA countries is suboptimal. The latest available data on national vaccination coverage for the first and second doses of measles-containing vaccine are presented in Figure 5 [5]. The vaccination coverage in 2016 for the second dose of measles-containing vaccine was below 95% in 22 of 29 EU/EEA countries with data (Figure 5). If the elimination goal is to be reached, vaccination coverage needs to increase in a number of countries as, operationally, the vaccination coverage target for the second dose has to be at least 95% to interrupt measles circulation.

**Figure 5. Vaccination coverage for the first (left panel) and second (right panel) doses of measles-containing vaccine by country, EU/EEA, 2016, WHO**



Since the beginning of 2018, large outbreaks of measles continue to be reported from Greece (1 131) [6], Romania (757) [2], France (429) [7], Italy (168) and Portugal (145) [8]. Smaller outbreaks of measles were also reported in other EU/EEA countries: Belgium (5), Czech Republic (23) [9], Germany (33) [10], Ireland (44) [11], Latvia (9) [12], Norway (4) [13], Poland (17), Sweden (28) [14] and the United Kingdom (42).

## Healthcare workers

In the EU/EEA, several measles outbreaks reported in 2017 and at the start of 2018 involved healthcare workers (HCW), including Belgium (35 cases in HCW) [15], Czech Republic (20 cases in HCW) [16], Italy (315 cases in HCW) [17], Greece (67 cases in HCW) [18], and Norway (2 cases in HCW) [13]. Transmission in healthcare settings has also been seen in countries with high vaccination coverage, e.g. Sweden (one case in HCW) [19] and Portugal (28 cases in HCW) [20]. As healthcare workers are prone to be in contact both with measles cases and with susceptible infants and immunocompromised patients, they have the potential to amplify measles transmission. Some countries, e.g. recently Denmark [21,22] and Sweden (Göteborg) [23], have taken specific measures to facilitate access to vaccination for unimmunised adults and for healthcare workers.

## Romania

ECDC has previously published a Rapid Risk Assessment on the outbreak in Romania [24]. According to the Romanian National Institute of Public Health (INSP), 11 123 confirmed cases of measles and 40 deaths have been registered since the beginning of the outbreak in early 2016 to 9 March 2018 [2]. The outbreak reached a peak of 1 315 cases in May 2017 [2]. The case count then dropped from around 300 cases per week between April and June, to 50 cases per week since the summer of 2017. The main circulating genotype in Romania was B3 and young children were the most affected, with 55% of the 5 608 cases reported to TESSy in 2017 aged under 5 years.

Despite the decreasing number of cases reported, Romania is still experiencing large case counts. In the first two months of 2018, 757 confirmed cases of measles were reported, including three deaths [2].

The vaccination coverage estimates for measles-containing vaccine in Romania submitted to WHO for 2016 were 86% and 76% for the first and second doses respectively [5].

## Italy

Since January 2017, the monthly case count in Italy increased through late winter to early spring, peaking in March 2017 with 943 cases reported. For 2017, Italy reported a total of 5 098 cases and four deaths. Adults were the most affected, with 68% of reported cases aged above 20 years. However, the highest incidence was recorded in infants below one year of age. In 2017, 88% (4 146) of cases with known vaccination status were reported to be unvaccinated and 7% were vaccinated with only one dose. The main circulating genotypes reported were B3 and D8.

In January 2018, Italy reported 168 cases of measles, including two deaths. Cases were reported from 12 regions with the majority from Sicily, Lazio, Calabria and Liguria. The median age of the cases is 25 years (range 2 days to 62 years), and 15 cases were children under one year of age. Among cases with known vaccination status, 93% were unvaccinated or had received one dose of measles-containing vaccine.

The vaccination coverage estimates for measles-containing vaccine in Italy submitted to WHO for 2016 were 85% and 83% for the first and second doses respectively [5]. In 2016, 87% of 2 year-olds had received one dose and 82% of 5–6 year olds had received two doses of measles containing vaccine [25].

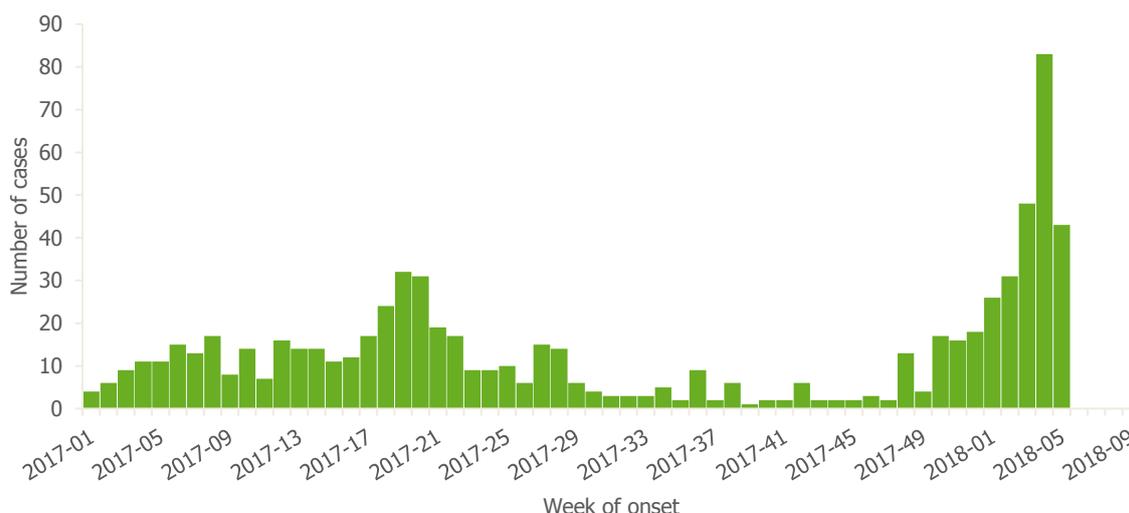
## France

In 2017, France reported a total of 518 cases, including one death. There was an increasing number of cases from the beginning of the year with an early peak in May (114 cases), followed by a sharp decline with fewer cases in the summer and autumn. In December 2017, France reported a new increase with 65 cases, compared with 13 and 11 cases in October and November respectively. Adults and children were equally affected. In 2017, genotype D8 and B3 were circulating, whereas in 2018, the circulating genotype is D8.

Since 6 November 2017, and as of 12 March 2018, 913 cases were reported including one death in February. Cases have been reported across almost all regions in the past weeks, with half of all cases from the region Nouvelle Aquitaine. Of 201 hospitalised patients, 78 had complications and nine required resuscitative care. Almost 90% of cases with known vaccination status occurred in persons who were incompletely vaccinated or unvaccinated [26].

The vaccination coverage estimates for measles-containing vaccine in France submitted to WHO for 2016 were 90% and 79% for the first and second doses respectively [5].

**Figure 6. Distribution of measles cases by week of onset, France, 2017–2018.**

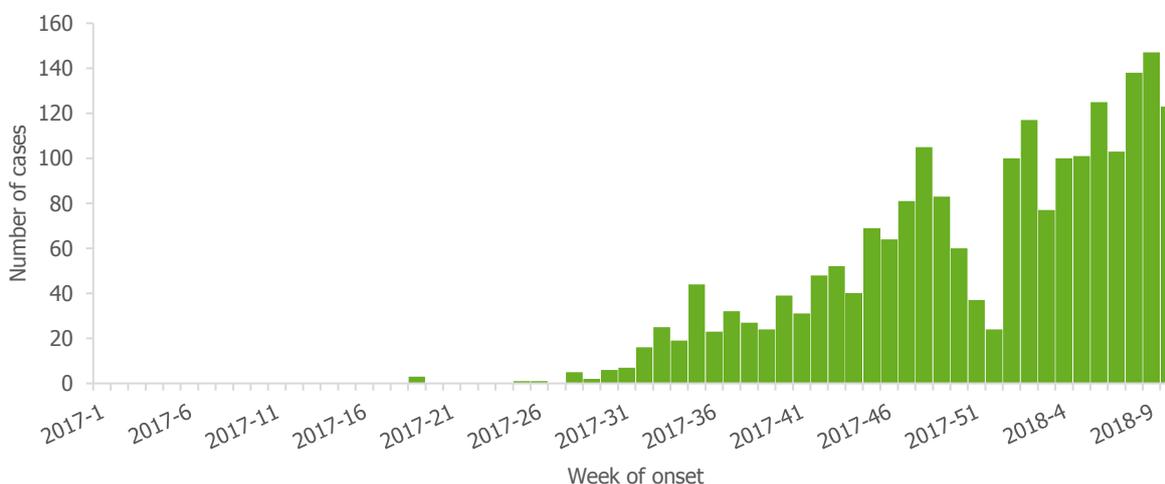


Source: TESSy as of 28 February 2018

## Greece

In Greece, a total of 2 099 measles cases have been reported since the beginning of the outbreak in May 2017 to 15 March 2018 to the Hellenic Center for Disease Control and Prevention (HCDCP). Of these cases, 1 131 were reported from January 2018 onwards [27]. During the previous three years (2014–2016) only two cases were reported. Three deaths were reported resulting from complications from measles. Of the 2 099 cases that were reported, 1 225 cases were laboratory confirmed, 728 cases were epidemiologically linked to laboratory-confirmed cases and 146 cases were classified as clinically compatible (Figure 7).

**Figure 7. Distribution of measles cases by week of onset, Greece, 2017–2018**



Note: Cases per week were calculated by subtracting total number of cases published in the weekly updates of the HCDCP from the total number of cases published in the previous update. Source: HCDCP as of 15 March 2018.

As of 4 March, most cases (64%) were in the Roma population followed by non-minority Greek nationals (25%). Of the total number, 69% (n=1 373) were children aged up to 14 years of age. Adults aged 20 years and older constituted 31% (n=503) of the total reported cases, mainly 25–44 years old. The outbreak mainly affects southern Greece and especially the regions of Dytiki Ellada, Peloponnese and Attica. Molecular characterisation of the circulating measles virus in Greece identified B3 genotype [18].

According to annual coverage reports submitted to WHO, estimated national immunisation coverage for measles-containing vaccine in 2016 was 97% and 83% for the first and second doses respectively [5]. Despite this high estimated national coverage, reliable estimates of vaccination coverage among the Roma population are limited. According to a recent study reporting a vaccination coverage survey of Roma children at national level in Greece, coverage for all vaccines was found to be very low [28].

## Portugal

A recent measles outbreak in the northern region of Portugal was reported to include 145 suspected cases of which 53 have been confirmed. Twenty-eight of the confirmed cases are healthcare workers [8,20]. Portugal reported 34 measles cases between February and May 2017. No cases were reported for 2016, nor for the period between June 2017 and January 2018.

The vaccination coverage estimates for measles-containing vaccine in Portugal submitted to WHO for 2016 were 98% and 95% for the first and second doses respectively [5].

## Neighbouring countries

### Ukraine

In European countries outside the EU, the largest outbreak of measles continues in Ukraine [29], with 6 484 cases in 2018 as of 6 March, including seven deaths (five children and two adults). Among the cases, 66% were children and 34% adults. Most of the cases were reported from Ivano-Frankivsk, Zakarpattia, Odesa, Chernivtsi and Lviv regions. In 2017, Ukraine reported 4 782 cases and seven deaths (four children and three adults). Vaccination coverage with measles-containing vaccines in Ukraine in 2017 doubled compared with 2016, with 93.3% of children under one year of age and 90.7% of six year-olds vaccinated.

### Balkan region

Outbreaks of measles were reported from the Balkan region in 2018. As of 12 March, 3 442 measles cases, of which 1 778 were laboratory confirmed, were detected in Serbia and from Kosovo\*. The majority of cases are below five years of age and over 30 years of age.

In Serbia, the majority of cases were reported from Belgrade. Of all cases, 95% were unvaccinated or had unknown vaccination status, 32% were hospitalised and 383 cases developed neurological or pulmonary complications. Since the beginning of the outbreak, nine people have died of pulmonary measles complications, including two children aged four and two years. Between 23 October 2017 and 12 March 2018, Kosovo\* and Metohija reported 334 cases of measles [30].

According to the annual Joint Reporting Form submitted to WHO, the first dose of measles-containing vaccine in Serbia is given at 12 months to children followed by a second dose at 7 years of age [31]. Vaccination coverage for the first and second dose of measles-containing vaccine has been around or below 90% for several years, with 82% for the first and 90% for the second dose in 2016 [5].

Albania has been experiencing a measles outbreak since December 2017. As of 23 February 2018, 162 cases have been confirmed in the country with the highest number of cases reported in Tirana and Lezhe [32,33].

The former Yugoslav Republic of Macedonia reported 19 cases of measles at the end of 2017 [34], and Bosnia and Herzegovina experienced an outbreak of measles in 2014 and 2015 with 3 000 and 1 677 cases, respectively [35].

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\* This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ opinion on the Kosovo declaration of independence.

## ECDC threat assessment for the EU

Measles cases in the EU/EEA principally occur in unvaccinated populations, affecting both adults and children. Large outbreaks with fatalities are ongoing in countries that had previously eliminated or interrupted endemic transmission as outlined below.

The progress towards elimination of measles in the European Region of WHO is assessed by The European Regional Verification Commission for Measles and Rubella Elimination (RVC). At the sixth meeting of the RVC for Measles and Rubella in June 2017, of the 53 countries in the WHO European Region, 33 (22 of which are in EU/EEA) 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, meaning that they are on their way to achieving the elimination goal. However, four EU/EEA countries were judged to still have endemic transmission of measles: Belgium, France, Italy and Romania (Table 1)[36].

The RVC assesses the status of countries based on a number of components: the epidemiological situation in the last 36 months, the molecular epidemiology, the surveillance performance, the population immunity, and the sustainability of the national immunisation programme [37]. Information regarding these components are submitted by National Verification Committees, which play an important role within Member States. The RVC will next convene in June 2018, and based on the current epidemiological situation, we can expect the status of some countries to change and some may have their elimination status revised.

**Table 1. Elimination status of EU/EEA Member States, based on the 2016 data review by the Regional Verification Commission meeting in June 2017.**

Elimination status	Country
EU/EEA Member States judged to have <b>eliminated the disease</b> ( $\geq 36$ 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 <b>interrupted endemic transmission</b> for 24 months	Ireland
EU/EEA Member States judged to have <b>interrupted endemic transmission</b> for 12 months	Austria, Germany, Poland
EU/EEA Member States judged to have <b>endemic transmission</b>	Belgium, France, Italy, Romania

Vaccination coverage and occurrence of cases are unequal within countries and demographic groups. Even if a country has an overall coverage of 95%, there is still the potential for outbreaks in subnational zones or communities with low coverage (i.e. they may be delimited either geographically or socio-demographically).

The high proportion of cases with unknown vaccination status among young adults (13% among 25–29 year-olds), highlights the importance of registration tools, in particular electronic registers to document vaccination status of individuals. Such registers have the potential to provide timely vaccination coverage data even at subnational level, something lacking in a number of Member States.

Some countries have seen an increasing proportion of cases among adults, prompting the need to consider catch-up campaigns. Member States are encouraged to identify existing immunity gaps in specific population groups to facilitate supplementary immunisation activities (SIAs).

Lastly, the frequent occurrence of measles among healthcare workers in several EU/EEA countries is a matter of concern, and Member States may consider specific interventions such as ensuring all healthcare workers are immune to measles, with proof/documentation of immunity or immunisation as a condition of enrolment into training and employment [38].

## Main conclusions and options for response

Immunisation is the only effective preventive measure against acquiring measles. All countries in the EU/EEA have measles vaccination policies in place with two doses using a measles-containing vaccine. Catch-up programmes for individuals having missed vaccination or for those who were too old to have been targeted by routine programmes exist in a number of countries. In response to ongoing outbreaks, several countries have taken exceptional measures to reinforce measles vaccination including Greece who have lowered the age of the second dose to the second year of life (instead of the second dose being given between 4 and 6 years in normal circumstances), and Denmark and Sweden who have facilitated vaccination of healthcare workers in addition to increased communication awareness campaigns.

Strengthening routine immunisation through facilitating access to vaccination, and mechanisms to identify people not or incompletely vaccinated are needed. Promoting and providing additional opportunities for immunisation through a variety of SIAs may also be needed in countries with suboptimal coverage and/or pockets of susceptible individuals.

Vaccination coverage of at least 95% of the general population at national and subnational levels with two doses of measles-containing vaccine is recommended and necessary to ensure that measles circulation is interrupted, and that introduction of measles cases does not result in secondary cases. This has not yet been achieved in all EU/EEA countries according to available vaccination coverage figures. The assessment of vaccination coverage rates and the availability of data at subnational level would allow identification of geographical areas where targeted actions may be needed.

Strengthening and ensuring high-quality surveillance, including monitoring the changing epidemiology of measles, helps guide public health actions. All suspected cases need to be detected and investigated in order to break chains of transmission as soon as possible. Epidemiological investigations, including assessing the susceptibility of contacts are needed to guide control measures [18]. Adequate laboratory investigation is essential as data on viral genotype are needed to track transmission chains.

In light of the current outbreaks in several EU countries, individuals who have not been immunised with two doses of measles-containing vaccine are at risk of contracting measles. National immunisation recommendations need to be followed-up and implemented. As the vaccine is highly effective, healthcare providers should consider recommending vaccination for all eligible individuals who are not immunised, or not fully immunised, in line with national recommendations. Any encounter with the healthcare system should be used as an opportunity for a catch-up vaccination against measles as well as other vaccine-preventable diseases.

Travel can be a trigger for people to get vaccinated. EU/EEA citizens travelling to countries or regions experiencing outbreaks are advised to ensure their vaccination status is up to date before travel.

Given the current extent of measles circulation in the EU/EEA, the trend in the recent years, and the fact that vaccination coverage for the first and second dose is suboptimal, there is a high risk of continued measles transmission with mutual exportation and importation between EU/EEA Member States and third countries.

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