

# Mumps

## Annual Epidemiological Report for 2018

### Key facts

- For 2018, 11 312 cases of mumps were reported to ECDC by 28 EU/EEA Member States with an overall notification rate of 2.6 cases per 100 000 population.
- There were no deaths reported and hospitalisation or complications due to mumps were rare, affecting 4.5% and 6.5% respectively, of the cases with data recorded on these outcomes.
- Italy, Poland, Spain and the United Kingdom accounted for 79% of all notified cases, with new or continuing outbreaks in these countries during the first half of the year responsible for the majority of cases.
- Mumps was more common among males than females across all age groups in the EU/EEA, with an overall male to female notification rate ratio of 1:3.
- Those aged 10-19 years experienced the highest age-specific notification rates and the highest proportion of cases vaccinated with two or more doses of measles, mumps and rubella (MMR) vaccine.
- Despite evidence of incomplete protection or waning immunity following vaccination, high MMR vaccination coverage remains of paramount importance to prevent mumps outbreaks, reduce disease severity and achieve measles and rubella elimination goals.

### Methods

This report is based on data for 2018 retrieved from The European Surveillance System (TESSy) on 11 March 2020. TESSy is a system for the collection, analysis and dissemination of data on communicable diseases. For a detailed description of methods used to produce this report, please refer to the *Methods* chapter [1].

An overview of the national surveillance systems is available online [2]. A subset of the data used for this report is available through ECDC's online *Surveillance atlas of infectious diseases* [3].

Twenty-eight EU/EEA Member States routinely report mumps data to ECDC. The majority use the 2008, 2012 or 2018 EU case definitions [4] and report data from comprehensive, passive surveillance systems with national coverage. Belgium and Poland reported aggregated data in 2018. Austria has reported no data since 2013; France and Liechtenstein reported no data.

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## Epidemiology

For 2018, 28 EU/EEA countries reported 11 312 cases of mumps, of which 6 082 (54%) were laboratory-confirmed. The remaining 2 948 cases were reported as probable (26%) and 2 282 as possible (20%).

Four countries (Italy, Poland, Spain and the United Kingdom) reported 79% of all notified cases. Of these countries Poland did not use the EU case definition for reporting purposes, as all their reported cases met the national case definition used for possible cases, which includes anyone meeting the clinical criteria of fever and sudden swelling of the parotid or other salivary glands [5]. Additionally, Italy, Ireland, Germany and Denmark did not use the EU case definition and cases were reported in three categories (possible, probable and confirmed).

The EU/EEA overall notification rate in 2018 was 2.6 cases per 100 000 population which is similar to the notification rate observed in 2014 (2.7), but lower than in 2013 (5.9), 2015 (3.1) and 2016 (3.4); (Table 1 and Figure 1).

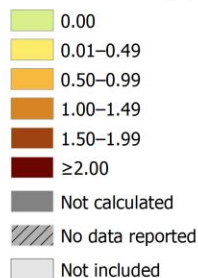
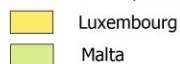
Notification rates ranged from 0.0 to 12.0 cases per 100 000 population in EU/EEA countries in 2018 (Table 1 and Figure 1). Ireland reported the highest notification rate, followed by Spain. Ireland reported a new increase (12.0) in the notification rate in 2018 after a sharp decrease in notification rates in 2015-16 followed by a subsequent smaller decrease in 2017 (from 43.1 to 10.3 to 6.1). However, the 2018 increase did not reach the levels of 2015-16. In Spain, the notification rate in 2018 (11.6) was similar to 2017 (12.6) and has been increasing gradually since 2014 (2.1), doubling in 2017 (12.6) compared with 2016 (5.6). Three countries reported a noticeable decrease in the notification rates over the last five years (2014-2018). In the Czech Republic, the notification rate continued the decreasing trend in 2018 (5.1) following the sharp fall from 2016 (54.3) to 2017 (13.3). Iceland reported a sharp decrease from 2015 (20.7) to 2016 (2.4) followed by a small increase in 2017 (3.0) and then a decrease in 2018 (0.9). The notification rate in Slovakia decreased sharply from 31.5 in 2015 to 3.7 in 2016, and has continued to decline from 2016 (3.7) to 2018 (0.2).

**Table 1. Distribution of mumps cases and rates per 100 000 population by country, EU/EEA, 2014–2018**

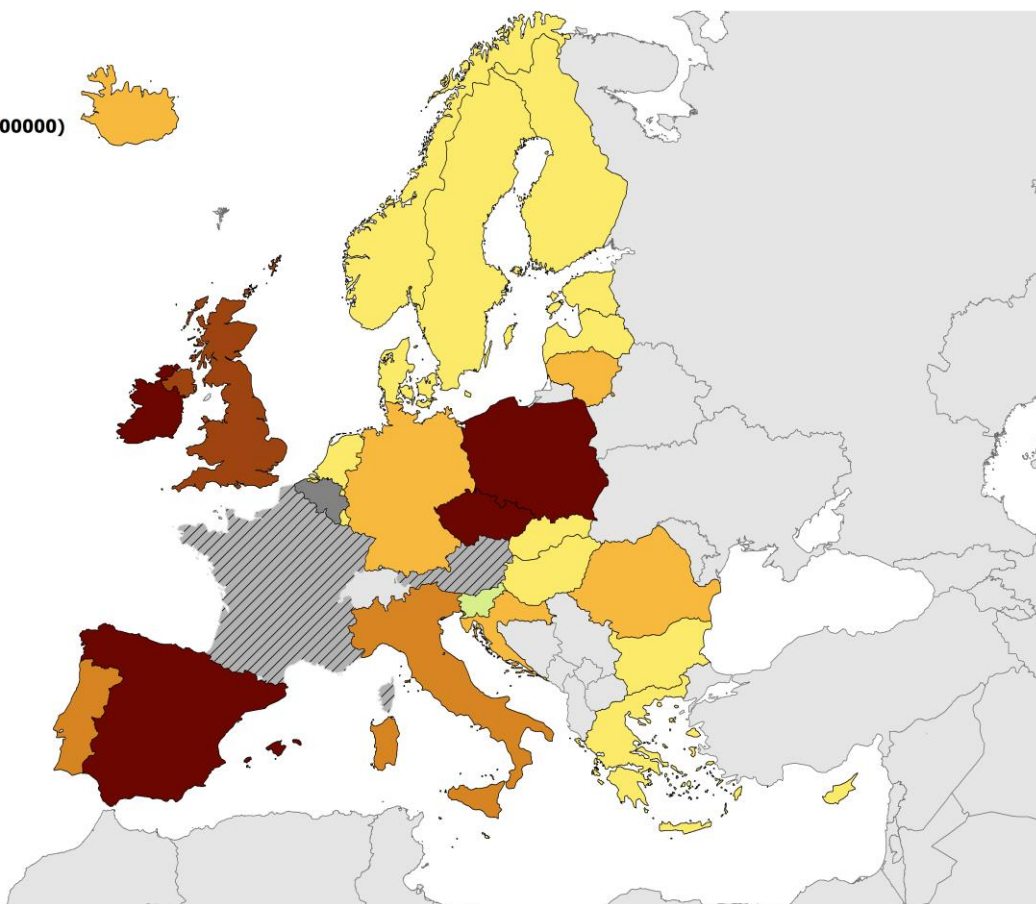
| Country        | 2014           |            | 2015           |            | 2016           |            | 2017           |            | 2018           |            |            |                 |
|----------------|----------------|------------|----------------|------------|----------------|------------|----------------|------------|----------------|------------|------------|-----------------|
|                | Reported cases | Rate       | Reported cases | Rate       | Reported cases | Rate       | Reported cases | Rate       | Reported cases | Rate       | ASR        | Confirmed cases |
| Austria        | .              | .          | .              | .          | .              | .          | .              | .          | .              | .          | .          | .               |
| Belgium        | 228            | -          | 163            | -          | 152            | -          | 183            | -          | 238            | -          | -          | 238             |
| Bulgaria       | 31             | 0.4        | 18             | 0.2        | 19             | 0.3        | 15             | 0.2        | 27             | 0.4        | 0.4        | 22              |
| Croatia        | 32             | 0.8        | 32             | 0.8        | 27             | 0.6        | 16             | 0.4        | 22             | 0.5        | 0.6        | 0               |
| Cyprus         | 1              | 0.1        | 2              | 0.2        | 1              | 0.1        | 2              | 0.2        | 3              | 0.3        | 0.3        | 2               |
| Czech Republic | 677            | 6.4        | 1 616          | 15.3       | 5 734          | 54.3       | 1 407          | 13.3       | 537            | 5.1        | 5.7        | 187             |
| Denmark        | 42             | 0.7        | 15             | 0.3        | 15             | 0.3        | 12             | 0.2        | 17             | 0.3        | 0.3        | 17              |
| Estonia        | 10             | 0.8        | 3              | 0.2        | 4              | 0.3        | 6              | 0.5        | 6              | 0.5        | 0.5        | 3               |
| Finland        | 2              | 0.0        | 2              | 0.0        | 6              | 0.1        | 10             | 0.2        | 4              | 0.1        | 0.1        | 4               |
| France         | .              | .          | .              | .          | .              | .          | .              | .          | .              | .          | .          | .               |
| Germany        | 835            | 1.0        | 703            | 0.9        | 741            | 0.9        | 653            | 0.8        | 534            | 0.6        | 0.7        | 315             |
| Greece         | 1              | 0.0        | 4              | 0.0        | 4              | 0.0        | 7              | 0.1        | 1              | 0.0        | 0.0        | 1               |
| Hungary        | 2              | 0.0        | 6              | 0.1        | 1              | 0.0        | 1              | 0.0        | 1              | 0.0        | 0.0        | 1               |
| Iceland        | 0              | 0.0        | 68             | 20.7       | 8              | 2.4        | 10             | 3.0        | 3              | 0.9        | 0.8        | 3               |
| Ireland        | 739            | 15.9       | 2 015          | 43.1       | 488            | 10.3       | 291            | 6.1        | 580            | 12.0       | 12.0       | 319             |
| Italy          | 821            | 1.4        | 675            | 1.1        | 782            | 1.3        | 829            | 1.4        | 777            | 1.3        | 1.5        | 702             |
| Latvia         | 11             | 0.5        | 21             | 1.1        | 6              | 0.3        | 4              | 0.2        | 2              | 0.1        | 0.1        | 0               |
| Liechtenstein  | .              | .          | .              | .          | .              | .          | .              | .          | .              | .          | .          | .               |
| Lithuania      | 45             | 1.5        | 39             | 1.3        | 53             | 1.8        | 45             | 1.6        | 19             | 0.7        | 0.7        | 19              |
| Luxembourg     | 1              | 0.2        | 0              | 0.0        | 0              | 0.0        | 1              | 0.2        | 1              | 0.2        | 0.2        | 1               |
| Malta          | 3              | 0.7        | 4              | 0.9        | 2              | 0.4        | 2              | 0.4        | 0              | 0.0        | 0.0        | 0               |
| Netherlands    | 38             | 0.2        | 87             | 0.5        | 70             | 0.4        | 45             | 0.3        | 72             | 0.4        | 0.4        | 60              |
| Norway         | 18             | 0.4        | 181            | 3.5        | 83             | 1.6        | 18             | 0.3        | 11             | 0.2        | 0.2        | 11              |
| Poland         | 2 508          | 6.6        | 2 208          | 5.8        | 1 978          | 5.2        | 1 670          | 4.4        | 1 585          | 4.2        | -          | 0               |
| Portugal       | 82             | 0.8        | 146            | 1.4        | 138            | 1.3        | 179            | 1.7        | 106            | 1.0        | 1.2        | 5               |
| Romania        | 107            | 0.5        | 449            | 2.3        | 643            | 3.3        | 316            | 1.6        | 120            | 0.6        | 0.7        | 28              |
| Slovakia       | 1 559          | 28.8       | 1 707          | 31.5       | 203            | 3.7        | 29             | 0.5        | 13             | 0.2        | 0.2        | 3               |
| Slovenia       | 1              | 0.0        | 1              | 0.0        | 0              | 0.0        | 3              | 0.1        | 0              | 0.0        | 0.0        | 0               |
| Spain          | 959            | 2.1        | 1 579          | 3.4        | 2 614          | 5.6        | 5 862          | 12.6       | 5 423          | 11.6       | 13.5       | 2 934           |
| Sweden         | 21             | 0.2        | 23             | 0.2        | 22             | 0.2        | 32             | 0.3        | 21             | 0.2        | 0.2        | 18              |
| United Kingdom | 2 858          | 4.4        | 1 800          | 2.8        | 999            | 1.5        | 2 046          | 3.1        | 1 189          | 1.8        | 1.9        | 1 189           |
| <b>EU/EEA</b>  | <b>11 632</b>  | <b>2.7</b> | <b>13 567</b>  | <b>3.1</b> | <b>14 793</b>  | <b>3.4</b> | <b>13 694</b>  | <b>3.1</b> | <b>11 312</b>  | <b>2.6</b> | <b>2.8</b> | <b>6 082</b>    |

Source: Country reports. Legend: ASR: age-standardised rate, . = no data reported, - = no notification rate calculated

**Figure 1. Distribution of mumps cases per 100 000 population by country, EU/EEA, 2018**


**Notification rate (N/100000)**

**Countries not visible in the main map extent**


ECDC. Map produced on: 30 Mar 2020

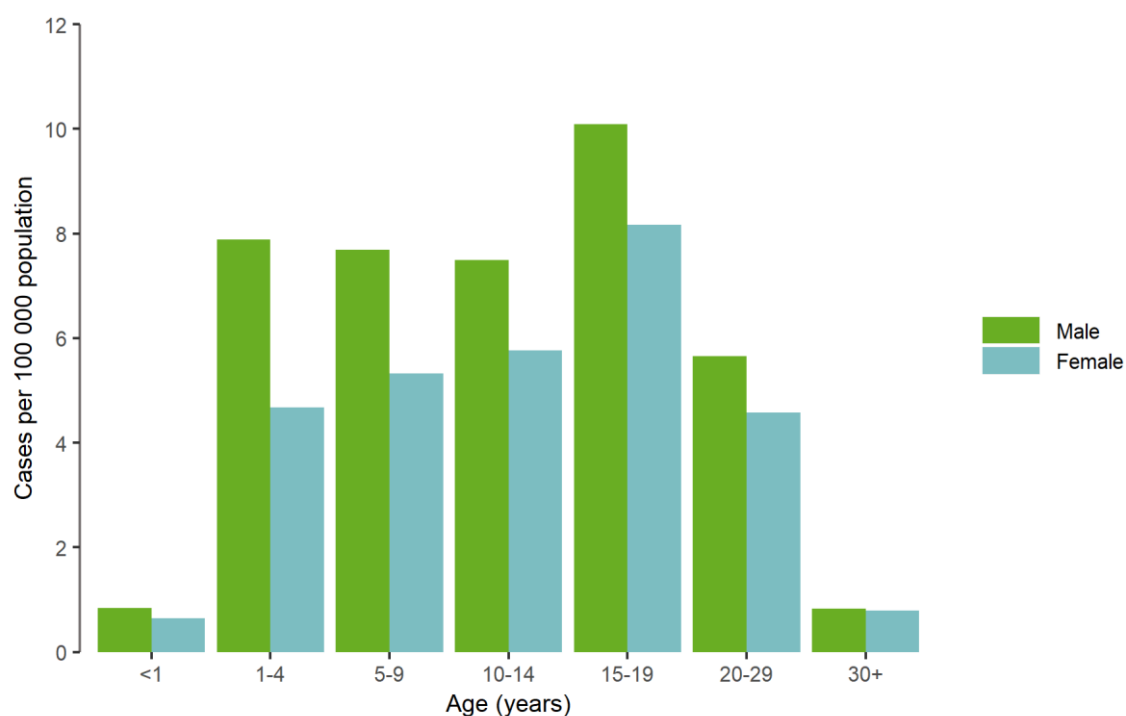


## Age and gender

In 2018, notification rates were six to nine times higher among those aged between one and 29 years than among those aged under one year or 30 years and over. The most affected age group was 15–19 years with a notification rate of 9.2 cases per 100 000 population followed by the 10–14 years group (notification rate 6.7). In terms of absolute case numbers, the highest burden fell among adolescents. Of the 11 283 cases with known age, slightly less than a third (31.1%) were aged 10–19 years. Among those below the age of 10 and over 19 years, the distribution over the total was: 0–9 years 23% and 20 years and over 45%.

The median age of cases across all EU/EEA countries submitting case-based data in 2018 (i.e. excluding Belgium and Poland) was 22 years (interquartile range, IQR: 13–28 years) and has remained stable since 2014, when it fluctuated between 20 and 21 years.

Mumps was more common among males than females in all age groups (Figure 2), with overall notification rates of 3.0 and 2.2 per 100 000 population and an overall male to female notification rate ratio of 1.3. Notification rates in fourteen countries (Bulgaria, Croatia, Cyprus, the Czech Republic, Estonia, Germany, Ireland, Italy, Lithuania, Luxembourg, Poland, Portugal, Romania, Spain) were higher among males than females while four countries had the same notification rate between males and females (The Netherlands 0.4, Sweden 0.2, United Kingdom 1.8 and Norway 0.2).

**Figure 2. Distribution of mumps cases per 100 000 population, by age and gender, EU/EEA, 2018**

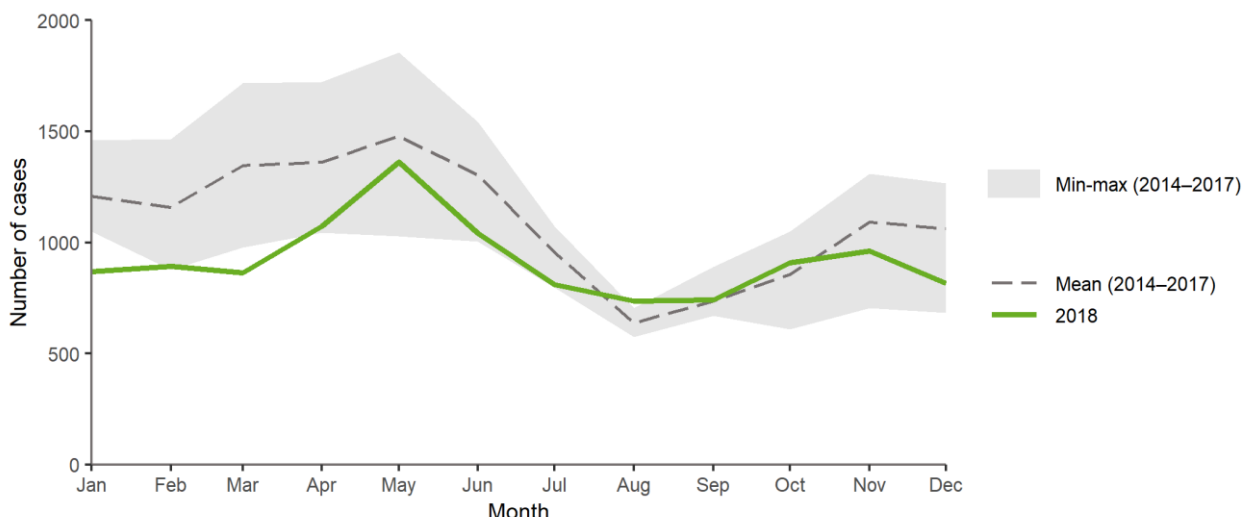
The burden of mumps varied considerably by age between countries in 2018. Four countries reported the highest notification rate among those aged five to nine years (Bulgaria, Estonia, Germany and Poland) and four others among 10–14 years (Cyprus, Czech Republic, Slovakia and Iceland). Five countries reported the highest notification rate among those aged one to four years (Croatia, Italy, Lithuania, Portugal and Romania) and 15–19 years (Greece, Ireland, Latvia, Spain and United Kingdom). Six countries reported the highest notification rate among those aged 20–29 years (Denmark, Finland, Luxembourg, Netherlands, Sweden and Norway).

Notably, high age-specific notification rates were reported by Ireland in the 15–19 and 20–29 years groups (54.3 and 28.5 per 100 000 population, respectively), compared with an average all-ages rate of 12 years in the country. Similarly, Spain reported high-specific notification rates in the 15–19 and 20–29 years groups (53.8 and 33.2 per 100 000 population, respectively), compared with an all-ages rate of 13.5. Czech Republic reported the highest age-specific notification rate in the 10–14 years age group (36.0 per 100 000 population) followed by the 15–19 years group (29.4 per 100 000 population), compared with an all-ages rate of 5.7.

## Seasonality and trend

Between 2014 and 2017, the seasonal trends of reported mumps cases was characterised by a peak in late spring (May) and the lowest number of cases reported in the late summer (August), which is consistent with what is described in the literature. In all years since 2014, the highest number of cases was reported in the first half of the year. In 2016 and 2017, this seasonality was more pronounced than in 2014–2015, with between 1.6 and 2.2 times as many cases reported in the first half of the year than the second half, compared with between 1.2 and 1.3 times in 2014–2015 (Figures 3 and 4). Also, in the first half of the year in 2018, there were 1.3 times as many cases than in the second half.

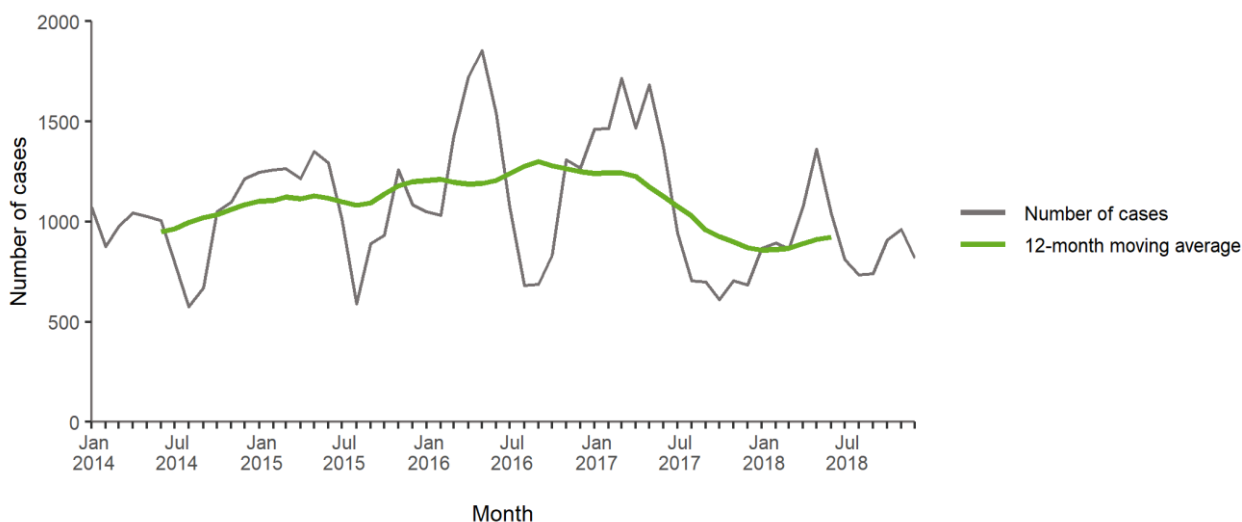
**Figure 3. Distribution of mumps cases by month, EU/EEA, 2018 and 2014–2017**



Countries included BG, CY, CZ, DE, DK, EE, EL, ES, FI, HR, HU, IE, IS, IT, LT, LV, MT, NL, NO, PL, PT, RO, SE, SI, SK, UK

Source: Country reports from Bulgaria, Cyprus, Czech Republic, Germany, Denmark, Estonia, Greece, Spain, Finland, Croatia, Hungary, Ireland, Iceland, Italy, Lithuania, Latvia, Malta, Netherlands, Norway, Poland, Portugal, Romania, Sweden, Slovenia, Slovakia and United Kingdom.

**Figure 4. Distribution of mumps cases by month, EU/EEA, 2014–2018**



Countries included BG, CY, CZ, DE, DK, EE, EL, ES, FI, HR, HU, IE, IS, IT, LT, LV, MT, NL, NO, PL, PT, RO, SE, SI, SK, UK

Source: Country reports from Bulgaria, Cyprus, Czech Republic, Germany, Denmark, Estonia, Greece, Spain, Finland, Croatia, Hungary, Ireland, Iceland, Italy, Lithuania, Latvia, Malta, Netherlands, Norway, Poland, Portugal, Romania, Sweden, Slovenia, Slovakia and United Kingdom.

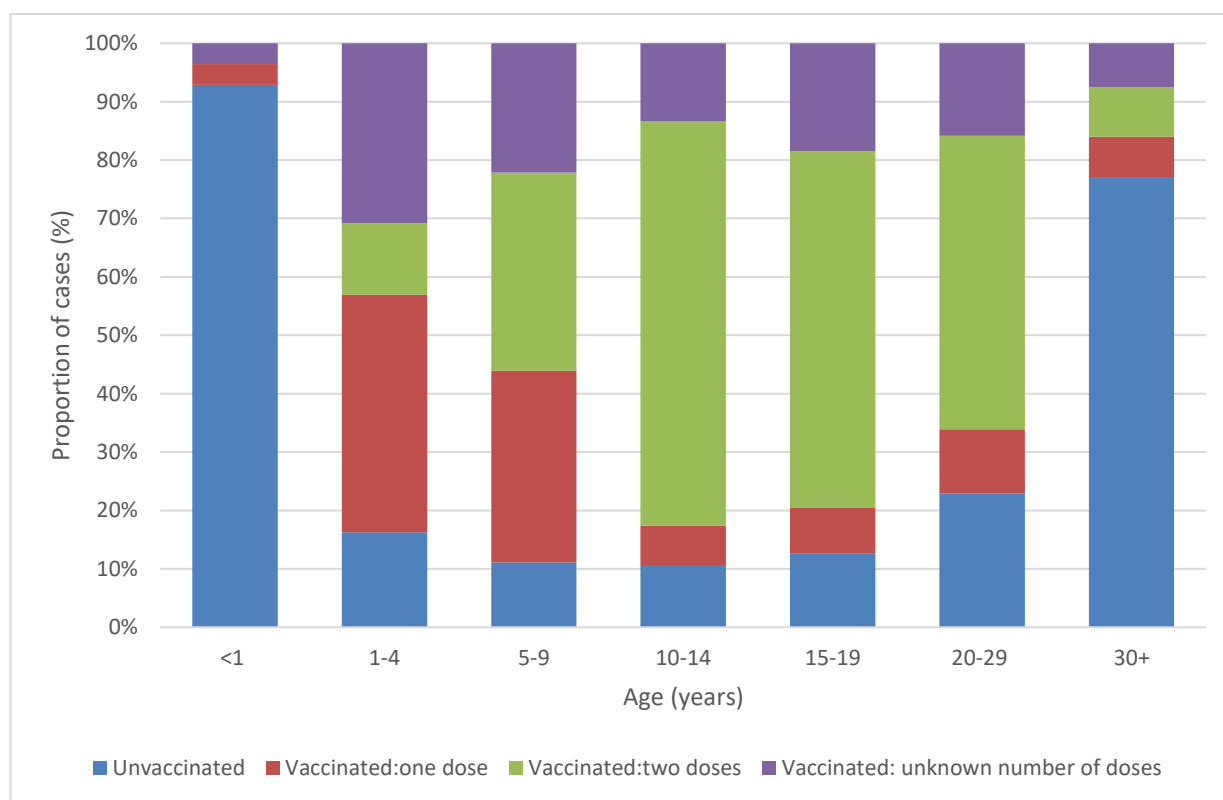
The seasonality observed in 2018 in the EU/EEA was driven largely by a sharp rise in case numbers in Spain and the United Kingdom as well as ongoing outbreaks in Poland in the months of April, May and June.

## Vaccination status

Data on vaccination status were available for 8 427 cases (74.5%). Of these cases, 2 176 (26%) were unvaccinated, 1 330 (16%) were vaccinated with one dose of the measles, mumps and rubella (MMR) vaccine, 3 387 (40%) with two doses, and 87 (1%) with three or more doses. Additionally, of these cases, 1 447 cases (17%) were reported as having been vaccinated with an unknown number of doses. Among laboratory-confirmed cases with known vaccination status, 31% were unvaccinated, compared with 15% of probable cases and 16% of possible cases.

The highest proportion of unvaccinated cases were among those aged under one year (below the age of routine vaccination against mumps). The number of unvaccinated cases 30 years and older accounted for 50% of the total number of unvaccinated cases. The majority of cases vaccinated with at least two doses were aged 5-29 years, with the 15-19, 10-14 and 20-29 years age groups represented at 29%, 26% and 26% of cases, respectively, being fully vaccinated (Figure 5).

**Figure 5. Distribution of mumps cases by age group and vaccination status, EU/EEA, 2018**



Vaccination status was more likely to be unknown among cases aged 20-29 years (33% of cases in that age group) and 30+ years (43%) than for the younger age groups (12-21% of cases by age group).

## Outcome

The outcome of disease was known for 6 479 (57%) of all cases, with no deaths reported in 2018.

## Hospitalisation and complications

Of 6 645 cases with known hospitalisation status (76%), 300 (4.5%) were hospitalised. Data on complications were reported by 20 countries for 2 802 cases, of which 2 619 (93.5%) had no complication. Nine countries reported 183 cases with complications, of which slightly more than four-fifths (81%) were reported by the Czech Republic (29%), Germany (24%), the United Kingdom (17%) and Romania (11%). Reported complications included 65 episodes of orchitis, 17 episodes of pancreatitis, 12 episodes of meningitis and five episodes of encephalitis. Unspecified complications ('other') were reported for another 86 cases. Complications were more frequently reported in adolescents and young adults than in children, with a median age of cases per complication of 28 (IQR: 18-39) years for encephalitis, 25 (IQR: 12-33) years for other complications, 25 (IQR: 18-32) years for orchitis, 27 (IQR: 16-38) years for meningitis and 35 (IQR: 22-49) years for pancreatitis.



## Discussion

From 2014 to 2018, the notification rate for mumps in the EU/EEA has remained relatively stable, fluctuating between 2.7 (in 2014) and 2.6 (in 2018) cases per 100 000 population. The epidemiology of mumps in the EU/EEA in 2018 was heavily influenced by four countries (Italy, Poland, Spain and the United Kingdom) which together accounted for 79% of all 11 312 notified cases, with Spain alone contributing with 48% of all cases.

All EU/EEA Member States have mumps vaccination via MMR in their routine childhood immunisation schedules, which has significantly reduced the associated disease burden compared with the pre-vaccine period. Case numbers reported to ECDC in 2018 represent an eight-fold decrease compared with cases reported to EUVAC.NET in 2000 (92 000) and a 19-fold decrease compared with the peak of 2004 (215 000 cases). However, mumps epidemics continue to occur in the EU/EEA.

Analysis of the monthly time series for the 12-year period 2007-2018 reveals between-country heterogeneity in periodicity and trends. For example, the United Kingdom has reported increases in the first half of almost every year with larger epidemics every three to four years, but an overall decreasing trend, with fewer annual cases between 2015 and 2018 than in 2006-2014. The inter-epidemic period in Spain and Czech Republic appears to be longer (four to six years) with smaller and less regular intermediate increases.

Several factors may explain some of the observed differences in the epidemiology between Member States, including differences in surveillance systems, historical or current vaccination policies, and vaccination coverage levels. However, general features of mumps epidemiology common to many EU/EEA countries and North America include an increase in the age of infection compared with the pre-vaccine period, particularly in the years following the introduction of a two-dose MMR vaccination schedule, and a high proportion of cases among adolescents or young adults that have received two doses of MMR.

Increases over time since 2004 in age-specific incidence rates among people aged 15 years and above during Spanish mumps epidemics have been seen [6], and in the USA a resurgence of mumps outbreaks affecting mainly those aged 18-29 years has been reported since 2006 [7, 8]. The annual age distributions of mumps cases from the EU/EEA since 2000 support these observations, with the highest proportion between 2000 and 2006 among those aged five to nine years, increasing to 15 years and above 2007-2017. Overall, slightly less than a third (31.1%) of cases in Europe in 2018 were aged 10-19 years and this age group accounted for 60%, 46% and 35% of all cases in Czech Republic, Ireland and Spain, respectively.

Many large outbreaks have been reported in which a high proportion of cases have been fully vaccinated with two doses of MMR, usually characterised by high attack rates among adolescents and young adults and often occurring in closed settings such as universities, boarding schools and military barracks [7, 9-16]. EU/EEA data from 2018 showed that 41% of cases with known vaccination status were vaccinated with at least two doses and there was a substantial over-representation of these cases among those aged 10-29 years. This may be due to a combination of incomplete protection offered by two doses of the mumps component of the MMR vaccine, waning immunity and intensity of social contact that facilitates virus transmission [7, 9]. The Czech Republic in 2018 modified the vaccination programme, shifting of the second dose of vaccine from two years of age to the preschool age (five to six years old) to delay the immunity waning that may account for the higher susceptibility of adolescents and young adults to mumps in the country [7].

Genotypic variation between the vaccine strain and the circulating virus may also be a factor [14, 15], but its contribution to changes in vaccine effectiveness over time has been disputed [7]. While administration of MMR in childhood may not offer complete individual protection against mumps in later life, the importance of maintaining high population MMR coverage cannot be overstated. The vaccine has been highly effective at reducing the overall morbidity and mortality of each of the three of the diseases it protects against [17], sustained high vaccination coverage lowers the likelihood of outbreaks occurring in a population [18, 19], and being vaccinated also has a direct protective effect on mumps disease severity [16, 20, 21]. A third dose of MMR vaccine can be effective at lowering the risk of mumps during an outbreak [22], but the relatively short duration of the antibody response following a third dose has raised questions about its general applicability beyond outbreak control [23].

## Public health implications

Mumps epidemics continue to occur in the EU/EEA, with vaccinated adolescents and young adults particularly affected. Further research is needed into ways to improve the effectiveness and duration of protection offered by the mumps component of the MMR vaccine [24]. Despite evidence of incomplete protection or waning immunity following vaccination, high MMR vaccination coverage remains of paramount importance to prevent mumps outbreaks, reduce disease severity and progress towards measles and rubella elimination. Administering a third dose of MMR to adolescents and young adults can be considered as an outbreak control measure.

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