Introduction

The following measles surveillance report covers the year 2006 and aims to describe basic epidemiological features of measles in the 32 EUVAC.NET participating countries. In this report incidence rates are based on reported measles cases per 10^5 inhabitants per year.

Methods

Measles surveillance data were available for all 32 countries reporting for the whole year. Twenty-nine countries provided case-based data obtained through national mandatory notification systems. Belgium provided data collected through a non-mandatory notification system. Romania and Turkey provided aggregated data (Table 1). All clinical, laboratory-confirmed or epidemiologically linked cases meeting the requirements for national surveillance were included in the analysis.

Table 1. *Measles surveillance data source by country, 2006*

Countries reporting case-based data			
Austria	Finland	Latvia	Slovakia
Belgium	France	Lithuania	Slovenia
Bulgaria	Germany	Luxembourg	Spain
Croatia	Greece	Malta	Sweden
Cyprus	Hungary	The Netherlands	Switzerland
Czech Republic	Iceland	Norway	United Kingdom
Denmark	Ireland	Poland	
Estonia	Italy	Portugal	
Country reporting aggregated data			
Romania			
Turkey			

Data analysis was based on cases with disease onset in 2006. In 110 (2%) case-based reports the disease onset dates were not available. However, these cases were included in the analyses on the basis of their date of notification or date of collection of laboratory sample being in 2006. In some countries minor discrepancies with nationally reported data may arise if these include cases reported in 2006 but with disease onset in 2005.

Incidence rates were based on population statistics for 2006 obtained from the Population Information page on the WHO website for the Computerized Information System for Infectious Diseases (CISID), http://data.euro.who.int/cisid/. Variables that had no data in the case-based reports were converted to an unknown status.

In addition to case-based data collected through national mandatory notification systems, Italy and Switzerland also provided sentinel surveillance data.

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Incidence – notifications and laboratory data

A total of 8,213 measles cases was reported from all 32 EUVAC.NET countries giving a crude incidence of 1.41 per 100,000 inhabitants. Data on 4,983 (61%) were case-based and classified as seen in figure 1a. Data on the rest of the cases (39%) were aggregated data from Romania and Turkey (Figure 1b).

Figure 1a. *Diagnosis classification of measles cases from case-based reports, 2006 (n=4,983)*

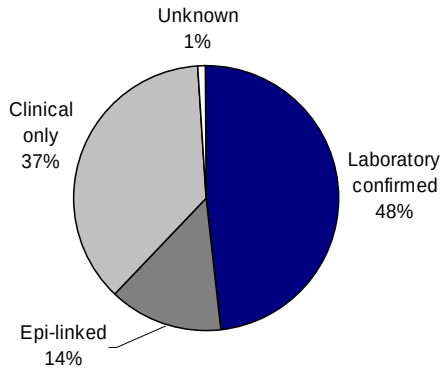
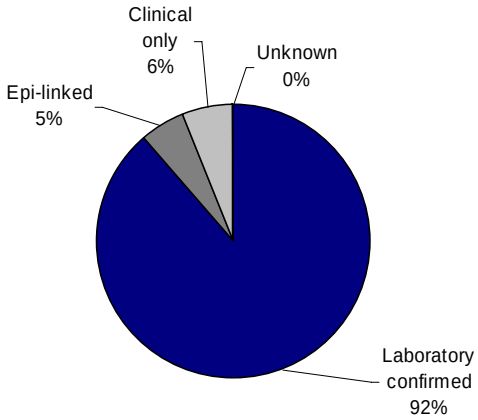


Figure 1b. *Diagnosis classification of measles cases from aggregate reports, 2006 (n=3,230)*



The distribution of reported measles cases varied considerably among the participating countries (Table 2). The highest incidence of measles notifications was reported from Romania followed by Greece with a crude incidence of 14.78 and 4.60 per 100,000 inhabitants respectively.

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Table 2. *Reported measles cases and laboratory confirmed cases by country, 2006 (n=8,213)*

Country	*No. of reported cases*	*Crude incidence per 100,000 inhabitants*	*Confirmed cases* as a % of no. reported*	*Laboratory confirmed as a % of total confirmed cases*
Austria	21	0.26	71%	100%
Belgium	15	0.14	60%	89%
Bulgaria	1	0.01	100%	100%
Croatia	1	0.02	0%	-
Cyprus	0	0.00	-	-
Czech Republic	6	0.06	100%	100%
Denmark	27	0.50	100%	96%
Estonia	27	2.04	100%	100%
Finland	0	0.00	-	-
France	45	0.07	40%	94%
Germany	2,307	2.79	64%	57%
Greece	512	4.60	42%	100%
Hungary	1	0.01	100%	100%
Iceland	0	0.00	-	-
Ireland	83	1.97	28%	100%
Italy	595	1.02	0%	-
Latvia	7	0.30	86%	100%
Lithuania	1	0.03	0%	-
Luxembourg	7	1.49	0%	-
Malta	0	0.00	-	-
The Netherlands	1	0.01	100%	100%
Norway	0	0.00	-	-
Poland	120	0.31	76%	97%
Portugal	0	0.00	-	-
Romania	3,196	14.78	94%	94%
Slovakia	0	0.00	-	-
Slovenia	0	0.00	-	-
Spain	343	0.79	96%	90%
Sweden	19	0.21	95%	100%
Switzerland	71	0.98	66%	87%
Turkey	34	0.05	100%	100%
United Kingdom	773	1.29	100%	99%
Total	**8,213**	**1.41**	**74%**	**86%**

* Confirmed cases include both laboratory-confirmed cases and epidemiologically-linked cases.

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In table 3, countries have been grouped into low, moderate and high incidences based on reported indigenous (non-imported) measles cases. No indigenous cases were reported from 11 countries: Bulgaria, Croatia, Cyprus, Finland, Hungary, Iceland, Malta, Norway, Portugal, Slovakia and Slovenia.

Table 3. *Reported incidence of indigenous measles cases per 100,000 inhabitants by country, 2006*

High incidence (>1.0)		
Estonia (1.89)	Ireland (1.97)	*Romania (14.78)**
Germany (2.75)	Italy (1.02)	United Kingdom (1.25)
Greece (4.60)	Luxembourg (1.49)	
Moderate incidence (0.1-1.0)		
Austria (0.22)	Latvia (0.17)	Switzerland (0.91)
Belgium (0.12)	Poland (0.30)	
Denmark (0.40)	Spain (0.74)	
Low incidence (< 0.1)		
Czech Republic (0.02)	Lithuania (0.03)	Sweden (0.09)
France (0.06)	The Netherlands (0.01)	*Turkey (0.05)**
Zero incidence		
Bulgaria (0)	Hungary (0)	Portugal (0)
Croatia (0)	Iceland (0)	Slovakia (0)
Cyprus (0)	Malta (0)	Slovenia (0)
Finland (0)	Norway (0)	

* For Romania and Turkey the crude incidence is quoted in this table as data on importation status of cases were not included in the aggregated dataset provided.

Outbreak-related and imported cases

Information on outbreak status was provided in 86% of case-based reports. Of these, there were 2,408 outbreak-related cases (Table 4) making up 56% of those with a known outbreak status. Most outbreak cases were reported from Germany (39%) followed by UK (28%). Although there were no case-based reports on outbreak cases from Romania, the country reported very high number of measles cases. Measles outbreaks in 2006 were reported from Greece,[1-2] Spain,[3-5] the Øresund Region of Denmark and Sweden,[6-7] Germany,[8-9] United Kingdom,[10-11] Italy,[12-15] and Poland.[16]

Importation status was known in 70% of case-based reports (Table 4). Of these, there were 126 imported cases amounting to 4% of case-based reports with known importation status. Sixty-four cases (51%) were imported from another European country. There were 62 imported cases (49%) from other parts of the world including, 30 from Asia, 14 from the Middle East, 16 from Africa, one from South America and one from Australia. The number of reported measles cases by country identified as a source of importation is seen in table 5.

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Table 4. *Reported measles cases: hospitalised, outbreak related and imported, by country, 2006*

Country	Hospitalised cases[1]			Outbreak-related cases[2]			Imported cases[2]		
	No. of cases (% of known hospitalisation status)		*% Unknown of total /no data*	*No. of cases (% of known outbreak status)*		*% Unknown of total /no data*	*No. of cases (% of known importation status)*		*% Unknown of total /no data*
Austria	15	71%	0%	10	48%	0%	3	38%	62%
Belgium	2	22%	40%	3	50%	60%	2	22%	40%
Bulgaria	1	100%	0%	0	0%	100%	1	100%	0%
Croatia	1	100%	0%	0	0%	0%	1	100%	0%
Cyprus	0	-	-	0	-	-	0	-	-
Czech Republic	6	100%	0%	0	0%	0%	4	67%	0%
Denmark	16	59%	0%	23	88%	4%	5	19%	0%
Estonia	26	96%	0%	25	93%	0%	2	7%	0%
Finland	0	-	-	0	-	-	0	-	-
France	14	35%	11%	3	7%	0%	10	26%	16%
Germany	344	15%	1%	950	41%	0%	33	1%	2%
Greece	357	73%	5%	354	69%	0%	0	0%	1%
Hungary	1	100%	0%	0	0%	0%	1	100%	0%
Iceland	0	-	-	0	-	-	0	-	-
Ireland	3	8%	55%	0	0%	60%	0	0%	72%
Italy	293	51%	3%	0	0%	100%	0	-	100%
Latvia	5	71%	0%	0	0%	0%	3	43%	0%
Lithuania	0	0%	0%	0	0%	0%	0	0%	0%
Luxembourg	0	0%	0%	7	100%	0%	0	0%	0%
Malta	0	-	-	0	-	-	0	-	-
The Netherlands	1	100%	0%	0	0%	100%	0	-	100%
Norway	0	-	-	0	-	-	0	-	-
Poland	75	63%	0%	42	35%	0%	3	3%	0%
Portugal	0	-	-	0	-	-	0	-	-
Romania [3]	2,777	100%	13%	n.r.	0%	0%	n.r.	-	-
Slovakia	0	-	-	0	-	-	0	-	-
Slovenia	0	-	-	0	-	-	0	-	-
Spain	101	31%	4%	275	81%	1%	20	6%	0%
Sweden	0	-	100%	8	57%	26%	11	85%	32%
Switzerland	12	18%	8%	45	100%	37%	5	9%	20%
Turkey [3]	1	100%	97%	n.r.	0%	0%	n.r.	-	-
United Kingdom	151	20%	0%	663	86%	0%	22	100%	97%
Total	**4,202**	**55%**	**7%**	**2,408**	**56%**	**14%**	**126**	**4%**	**30%**

[1]Denominator n=8,213. [2]Denominator n=4,983. [3]Aggregated data does not include information on outbreaks and importation status. n.r. = not reported

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Table 5. *Reported measles cases by country identified as source of importation, 2006 (n=126)*

Ukraine	17	Yugoslavia	3	Russia	2	Kazakhstan	1
Thailand	13	Bangladesh	2	South Africa	2	Luxembourg	1
Italy	11	China	2	United Kingdom	2	Mauritius	1
Pakistan	8	Egypt	2	Albania	1	Niger	1
India	8	France	2	Andorra	1	Seychelles	1
Romania	6	Greece	2	Australia	1	Somalia	1
Germany	5	Indonesia	2	Chile	1	Switzerland	1
Morocco	4	Lebanon	2	Denmark	1	Syria	1
Spain	6	The Netherlands	2	Hungary	1	Turkey	1
Ethiopia	4	Poland	2	Israel	1	United Arab Emirates	1

Note: This table needs to be interpreted with caution as the definition of an imported case may differ from country to country.

Age distribution and seasonality

Measles was reported in both children and adults. In countries reporting case-based data 65% of cases were less than 15 years old. While in countries reporting aggregated data 83% of cases belonged to this age group. The age group with the highest proportion of laboratory-confirmed cases was that <1 year of age (77%), followed by that of >20 years (71%) and least in the 10-19 year-age group (50%). Figure 2 shows the number of reported measles cases by age group and confirmation status.

Of the case-based reports most (81%) occurred in the first half of the year. Figure 3 shows the occurrence of measles by month of onset derived from case-based reports. Aggregated data did not include such information.

Figure 2. *Reported measles cases by age group and confirmation status in all reporting countries, 2006 (n=8,213)*

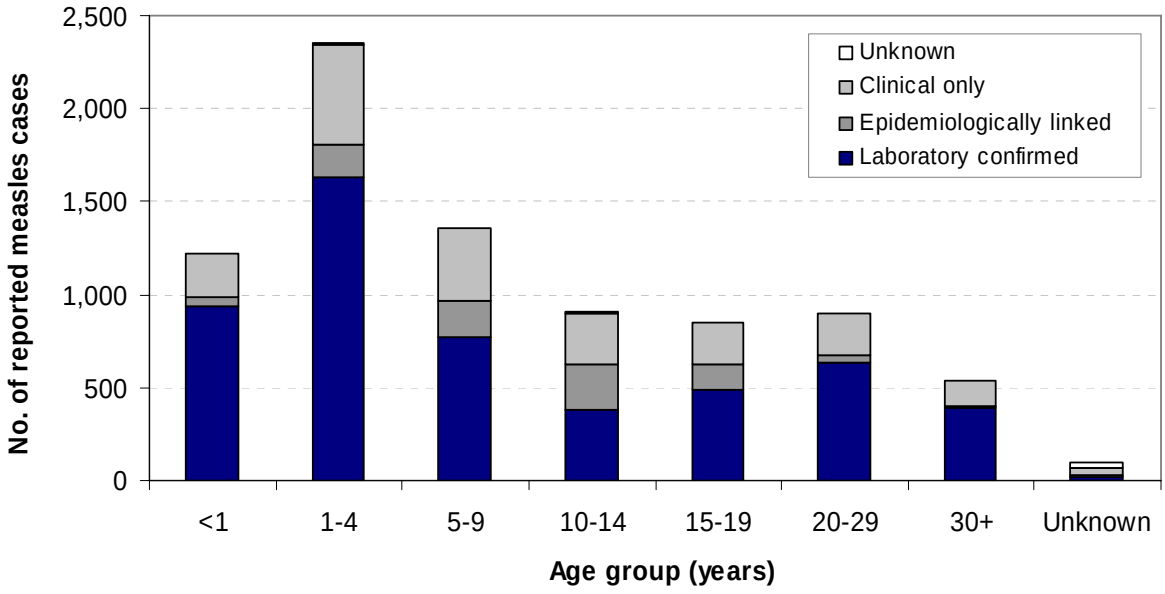

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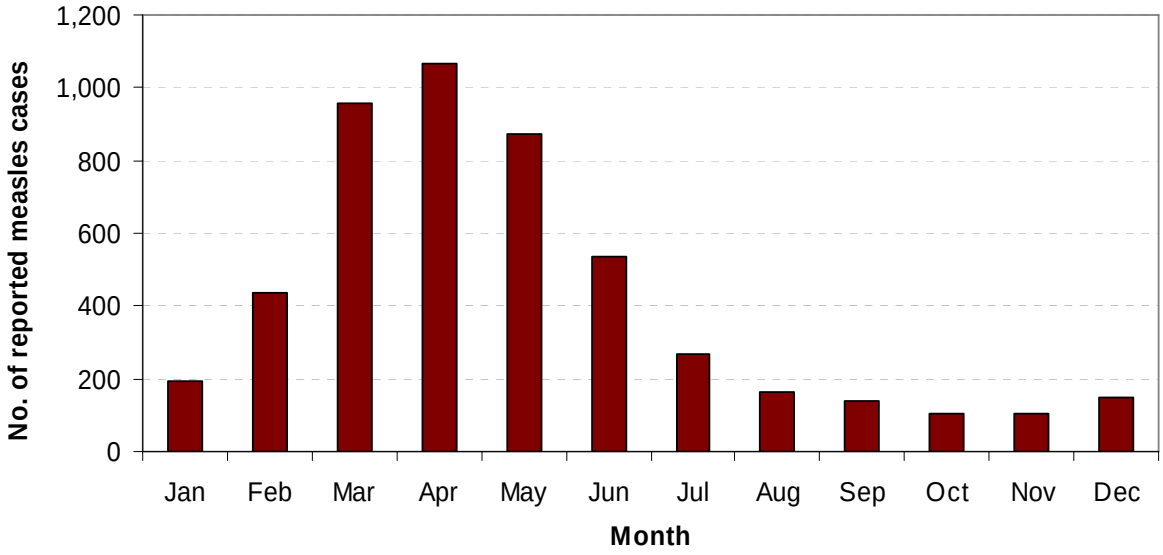
Figure 3. *Number of reported measles cases by month of disease onset from case-based reporting countries, 2006 (n=4,983)*



Vaccination status

Information on known vaccination status was provided in 89% of all reported measles cases. Overall, 77% of those with a known vaccination status were unvaccinated: 87% of measles cases from case-based reports (Figure 4a) and 60% of cases from aggregated data (Figure 4b).

Figure 4a. *Vaccination status of measles cases from case-based reports (n=4,983)*

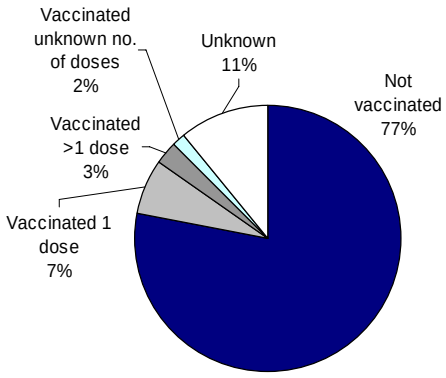


Figure 4b. *Vaccination status of measles cases from aggregate reports (n=3,230)*

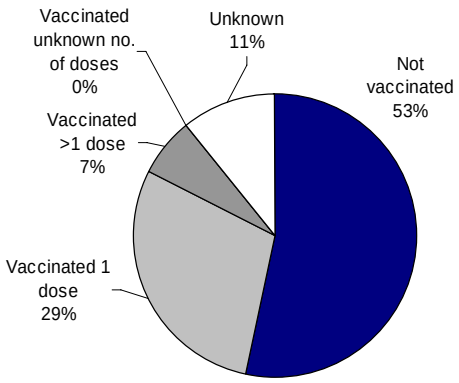


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Table 6. *Vaccination status of reported measles cases by country, 2006 (n=8,213)*

Country	*No. of unvaccinated cases (% of unvaccinated of known vaccination status)*		*No. of vaccinated cases (% vaccinated of known vaccination status)*		*No. with unknown vaccination status/no data (% unknown status /no data of total)*	
Austria	14	78%	4	22%	3	14%
Belgium	7	88%	1	12%	7	47%
Bulgaria	0	-	0	-	1	100%
Croatia	0	-	0	-	1	100%
Cyprus	0	-	0	-	0	-
Czech Republic	5	83%	1	17%	0	0%
Denmark	22	85%	4	15%	1	4%
Estonia	20	80%	5	20%	2	7%
Finland	0	-	0	-	0	-
France	23	62%	14	38%	8	18%
Germany	1,866	89%	239	11%	202	9%
Greece	361	91%	36	9%	115	22%
Hungary	1	100%	0	0%	0	0%
Iceland	0	-	0	-	0	-
Ireland	28	64%	16	36%	39	47%
Italy	459	87%	71	13%	65	11%
Latvia	0	-	0	-	7	100%
Lithuania	0	0%	1	100%	0	0%
Luxembourg	0	-	0	-	7	100%
Malta	0	-	0	-	0	-
The Netherlands	0	0%	1	100%	0	0%
Norway	0	-	0	-	0	-
Poland	63	59%	43	41%	14	12%
Portugal	0	-	0	-	0	-
Romania	1,711	60%	1,149	40%	336	11%
Slovakia	0	-	0	-	0	-
Slovenia	0	-	0	-	0	-
Spain	227	77%	67	23%	49	14%
Sweden	18	100%	0	0%	1	5%
Switzerland	52	88%	7	12%	12	17%
Turkey	14	67%	7	33%	13	38%
United Kingdom	725	94%	48	6%	0	0%
Total	**5,616**	**77%**	**1,714**	**23%**	**883**	**11%**

Morbidity and mortality

Data on known hospitalisation status was available in 93% of all reported measles cases. There were 4,202 reported hospitalised cases in connection with measles (Table 4) amounting to 55% of all cases with known hospitalisation status.

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In 2006, six deaths and 10 encephalitis cases were attributed to measles corresponding to an overall incidence of 73 and 122 per 100,000 measles cases respectively. Measles was laboratory-confirmed in all these cases. The deaths were reported from Romania (three cases), Germany (two cases) and the UK (one case). Of the cases from Romania, one was <1 year-old and the other two were in the 1-4 year-age group. Of the two cases from Germany, one was <1 year-old and the other was a 2-year-old boy previously unvaccinated against measles. The death reported from the UK occurred in a 13-year-old boy previously unvaccinated against measles.

The cases of encephalitis attributed to measles were reported from Germany (seven), Greece (one), Switzerland (one) and the UK (one). Two of the cases from Germany resulted in death and are mentioned above. Four other encephalitis cases from Germany were also previously unvaccinated against measles: one in the 1-10 year-age group and three in the 15-29 year-age group. In another case belonging to the latter age group, the vaccination status was unknown.

The encephalitis case from Greece occurred in a 22-month-old boy who was not previously vaccinated against measles. The case from Switzerland occurred in an 8-month-old infant before reaching the age for vaccination against measles, while the case from the UK occurred in a 27 year-old man who had received one dose of the measles vaccine.

Data from Sentinel Surveillance Systems

Besides case-based reporting Switzerland also provided sentinel surveillance data. The Swiss sentinel system involved the participation of about 3% of all primary care physicians who reported eight cases giving an extrapolated 200 cases and a crude incidence rate of 3 per 100,000 inhabitants.

In Italy, a paediatric sentinel surveillance system for childhood vaccine-preventable diseases (Sorveglianza Padiatri Sentinella – SPES[17]) involved 335 paediatricians caring for 2.5% of the paediatric population up to 14 years of age. The Italian paediatric sentinel surveillance system reported 10 cases giving a crude incidence rate of 4.9 per 100,000 children aged up to 14 years. Five (50%) of the cases were in the 1-4 year-age group.

Comments

There has been an overall decrease of 38% in reported measles cases in EUVAC.NET participating countries in 2006 compared with the previous year. The decline has by far been mostly attributed to the decreased number of reported cases in Turkey from 6,206 in 2005 to 34 in 2006. This was attributed to a massive nationwide measles vaccination in 2003-2005 campaign aimed at children less than 15 years old. It is also to be noted that in Turkey all 34 cases in 2006 were laboratory-confirmed compared with 18% of the total reported cases in 2005.

In contrast, many other countries reported an increase in indigenous incidence compared with 2005 notably Denmark, Estonia, Germany, Greece, Latvia, Luxembourg, Poland, Spain, Switzerland and the UK. As expected, the majority of measles cases occurred in unvaccinated cases. Overall, compared with 2005 there has been a significant change in the age distribution pattern with a 18% rise in cases aged >15 years.

Most imported cases were reported to occur in countries were outbreaks of measles have been documented or where endemic measles transmission still occurs. It is to be noted that the list of countries reported as sources of importation of measles (Table 5) has to be

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interpreted with caution since different countries may use different definitions of imported cases.

Although there has been a marked drop in the number of measles cases in EUVAC.NET countries, measles occurrence in many European countries still remains a cause of concern. The commitment to eliminate measles in Europe needs to be strengthened by increasing vaccination coverage with two doses of measles vaccines to a WHO recommended minimum of 95%. Additionally, enhanced surveillance from clinical to laboratory level needs to be undertaken for early identification and laboratory confirmation of cases. An increased level of suspicion in cases with rash, particularly in those >15 years old is important. Laboratory investigations including molecular characterization of measles virus help to better define outbreaks and identify imported measles thereby demonstrating the absence or presence of endemic measles.

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Reporters

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