

AN INCREASE IN THE NUMBER OF MUMPS CASES IN THE CZECH REPUBLIC, 2005-2006

N Boxall^{1,2}, M Kubíniová¹, V Příkazský (vladimir.prikazsky@ecdc.europa.eu)¹, C Beneš¹, J Částková¹

1. Státní Zdravotní Ústav (National Institute of Public Health), Prague, Czech Republic

2. European Programme for Intervention Epidemiology Training (EPIET)

The Czech Republic has had a two-dose measles, mumps and rubella (MMR) vaccination programme since 1987. The last outbreak of mumps was reported in 2002, but an increase in the number of mumps cases was observed in 2005, starting in October that year. We analysed routinely collected surveillance data from 1 January 2005 to 30 June 2006 to show the magnitude of the increase and describe the most affected groups in order to better target prevention and control strategies. In the 18-month period examined, 5,998 cases of mumps were notified, with a peak incidence in May 2006. No deaths were recorded, but 21% of cases were hospitalised. Incidence was lowest in the Plzeň region (1.9/100,000) and highest in Zlín (118.6/100,000). There were more male (61.8%) than female cases. The age of the cases ranged from 0 to 80 years. The highest incidence rate was observed in the age group of 15 to 19 years, in which 87% of cases had received two doses of mumps vaccine. The average age of unvaccinated cases was 22.9 years, while for cases vaccinated with two doses it was 14.5 years. Although vaccine effectiveness could not be calculated from the data available, possible reasons for highly-vaccinated cases occurring are discussed.

Introduction

Routine two-dose mass vaccination against measles, mumps and rubella (MMR) was introduced in the Czech Republic in 1987. The first dose is administered at 15 months of age, and the second dose is given six to 10 months later. Since 1984, the MMR vaccine used in the Czech Republic has been a Jeryl Lynn/genotype A vaccine TRIVIVAC produced by SevaPharma Inc. The mumps component produces antibody response in 70% in minimal titre 1:2 and 91% in titre 1:1 in haemagglutination-inhibition test (HIT). According to the manufacturer's information, after two doses given in a span of more than six months, the vaccine produced antibody in 100% subjects [1].

Mumps has been a notifiable disease in the Czech Republic since 1955. It was initially reported as aggregated number, then, as of 1982, as data aggregated by age groups (preschool, school children, youngsters and adults), and since 1993 as case-based data. Prior to the introduction of routine vaccination, disease incidence was highest in the 5-9 years age group [2]. In the last two decades, outbreaks of mumps occurred in 1995-6 (11,680 cases) and 2002-3 (1,501 cases). This paper presents the most recent outbreak in 2005-6 that was detected through routine surveillance.

Methods

The regional public health offices (Krajská hygienická stanice) notify individual cases of mumps in the Czech communicable

disease notification system (Epidat) to the National Institute of Public Health (Státní zdravotní ústav). Epidat contains all laboratory-confirmed cases and cases that meet the clinical case definition with an epidemiological link to a laboratory-confirmed case [3]. The clinical case definition for mumps is a person with an illness of acute onset of unilateral or bilateral tender, self-limited swelling of the parotid or other salivary gland, lasting two or more days without other apparent cause.

Epidemiological data of all notified cases of mumps in the Czech Republic reported between 1 January 2005 and 30 June 2006 were extracted and described in time, by region of notification, vaccination status, sex and age-group using Microsoft Excel. Cases were considered unvaccinated if they had no vaccination reported. Vaccinated cases were those who reported one or two doses of vaccination. In a small proportion of cases, the information about the number of doses or the vaccination status was not given. Reported complications included orchitis, meningitis, pancreatitis, encephalitis, and inflammation of the ovaries (oophoritis). Population data used for calculating incidence rates was prepared by the Czech Statistical Office (Český statistický úřad, <http://www.czso.cz/csu>) extrapolating forward each six months using birth, death, immigration and emigration figures available from the 2001 census. Vaccination coverage estimates for the entire population of the Czech Republic, not stratified by region for the period 1980-2006, were used as reported to World Health Organization [4,5].

The economic impact of mumps in the Czech Republic is potentially large, as persons with mumps are to be excluded from work for nine days (period of infectiousness being up to nine days after the onset of parotitis). We tried to estimate one important element of the economic impact of mumps by calculating the number of working days lost due to illness in people over the age of 19 years. We calculated the days (years) lost from work by multiplying the number of cases over 19 years by the number of days of exclusion from work. Complications were excluded from this calculation due to the variety in recovery time needed.

Results

Between 1 January 2005 and 30 June 2006, a total of 5,998 cases of mumps were notified in the Czech Republic (Figure 1). The numbers reported increased until mid-May 2006, when they started to slowly decrease. During weeks 1-30 of 2006, a total of 4,206 cases of mumps were notified; 2.8 times more in comparison with the same period in 2005 (1,456 cases). In the 18-month period studied, 1,209 cases of mumps (21.1%) were hospitalised, and no deaths were recorded.

Among the cases, 3,683 (61.8%) were males (Table 1). The age of cases ranged from 0 to 80 years (mean age was 17 years, median – 16 years). The highest incidence was in the age group 15-19 years.

Data on vaccination status were not available for 15 cases, and for a further 50 cases that had been vaccinated the number of doses was not specified (Figure 2). Over half of the cases had been vaccinated with two doses (4,187 cases, 69.8%). Their mean age was 14.5 years (median 15 years). Only 63 cases (1.0%) had been vaccinated with one dose. The unvaccinated cases were 1,683 (28.1%). The mean age of the unvaccinated cases was 22.9 years (median 21 years).

In the age group 15-19 years, in which most mumps cases occurred and the incidence was highest (230.1 per 100,000 per year), 87.1% of the cases were vaccinated. Incidence was also high in the 10-14 years age group (166.4 per 100,000 per year), born between 1992 and 1996, again a highly vaccinated population (99.6%). In addition to these highly vaccinated populations affected, the birth cohort born between 1981 and 1985 with low vaccination coverage had a quite high disease incidence of 101.8 cases per 100,000 per year.

In all, 910 cases developed complications (15.2%). Complications were more frequent among unvaccinated than vaccinated cases (32.3% versus 6.6%).

For cases vaccinated with one dose only the odds ratio (OR) for complications was 6.6 and for unvaccinated cases OR was 7.9 as compared to the fully vaccinated cases (Chi2 for trend=806; p for trend<0.00).

The most frequent complications were: orchitis in males (554 cases, 9.2% of all males), meningitis (166 cases, 2.8% of all cases), pancreatitis (121 cases, 2.0%) and encephalitis (16 cases, 0.3%). There were also three recorded cases of inflammation of the ovaries (oophoritis).

In the age group 25-34 years, the birth cohort with low vaccination coverage, 40.8% of the cases developed complications.

Regarding the geographical distribution of cases, the lowest incidence was reported in the Plzeň region (1.9 per 100,000) and the highest in the Zlín region (118.6 per 100,000) (Table 2, Figure 3).

In an attempt at estimating the economic impact of mumps, we calculated that 42 working years were lost as a direct result of the isolation of cases during this outbreak.

TABLE 1
Number of notified mumps cases and average annual incidence rates per 100,000 population, by age group and sex, Czech Republic, 1 January 2005 – 30 June 2006 (n=5,998)

Age group (years)	Number of cases			Incidence per 100,000/year		
	Male	Female	Total	Male	Female	Total
0	2	0	2	2.8	0.0	1.5
1 – 4	63	21	84	22.9	8.1	15.7
5 – 9	226	189	415	56.9	50.1	53.6
10 – 14	878	720	1,598	178.5	153.6	166.4
15 – 19	1,411	900	2,311	274.6	183.5	230.1
20 – 24	863	346	1,209	142.5	59.5	101.8
25 – 34	159	69	228	12.9	5.8	9.5
35 – 44	50	42	92	4.9	4.2	4.6
45 – 54	29	21	50	2.5	1.8	2.1
55 – 64	2	4	6	0.2	0.4	0.3
65 – 74	0	2	2	0.0	0.3	0.2
75 +	0	1	1	0.0	0.2	0.1
Total	3,683	2,315	5,998	49.5	29.5	39.2

FIGURE 1
Number of notified mumps cases, by week of notification, Czech Republic, 1 January 2005 – 30 June 2006 (n=5,998)

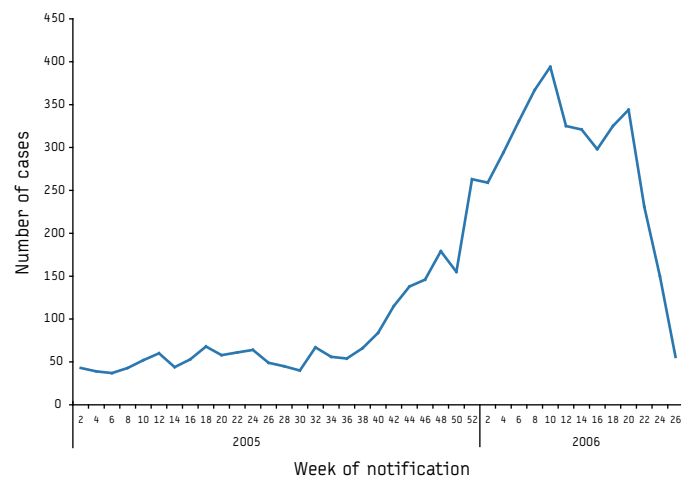
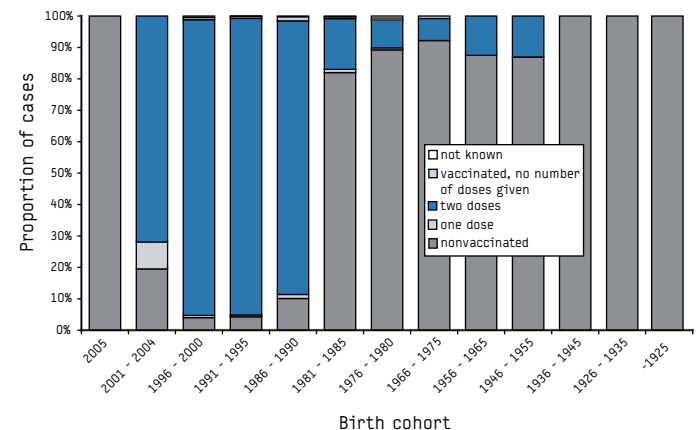


FIGURE 2
Mumps cases by birth cohort and vaccination status, Czech Republic, 1 January 2005 – 30 June 2006 (n=5,998)



Discussion

The outbreak described here began in late 2005 and continued until mid-2006. It was a regional outbreak that affected mostly the south-east of the Czech Republic. The outbreak affected mainly two different groups of people: a highly vaccinated birth cohort (1986 – 2004), and a birth cohort with low vaccination coverage (1971 – 1985), at considerable cost to the country.

We have described surveillance data alone; no analytical study was undertaken to examine the reasons for possible vaccination failure in the highly vaccinated birth cohorts that were affected. From the data available, we are unable to calculate the vaccine effectiveness.

The Czech Republic uses the live attenuated Jeryl Lynn strain of mumps virus for vaccination since the introduction of routine mumps vaccination. The strain is reported by the manufacturer to be highly safe and efficacious for vaccine use, and both more stable and immunogenic than alternative strain-based vaccines [1]. Though the reported data indicate high vaccine coverage achieved (97-100%), in a seroprevalence survey conducted in 2001, the prevalence of antibodies against mumps in age group 1-15 years (average 79%, range 70-86%) failed to correspond with declared mumps vaccination coverage rate of 97-100% [6]. The herd immunity induced is considered insufficient to prevent epidemics of mumps [7].

Formal epidemiologic studies are required to investigate whether there has been a reduction in vaccine effectiveness over time. It is

possible that vaccine effectiveness is lower than expected amongst the highly vaccinated birth cohorts born between 1986 and 2004. We remain uncertain as to what caused the outbreak amongst the younger vaccinated cohorts (born 1996-2004). Further studies are required to investigate risk factors for vaccine failure, such as whether the type of vaccine used (monovalent, bivalent or trivalent) affected the occurrence of the outbreak, or if there may have been failures in the cold-chain during vaccination. For the older vaccinated cohort (born 1986-1995) a plausible explanation would be the waning immunity or vaccine failure, as was demonstrated elsewhere [8,9].

The two different reasons for low effectiveness may prompt different intervention strategies. If failure to seroconvert means that 14-30% of the population is susceptible to mumps, then using a vaccine after which more people seroconvert would be of protective value to the community. If it appears that immunity is waning in the older vaccinated cohort, then the benefits of adding a booster vaccination, offered to young adults, should be considered.

Of the unvaccinated cases born between 1971 and 1985, all were born too early to have received the vaccine, but may have been too young to have developed 'natural immunity' following exposure to circulating wild mumps virus [2]. Catch-up vaccination campaigns may be conducted to obtain an immunisation rate of 90%, the recommended population immunity required to interrupt transmission.

Epidemics are seen among the group with low vaccination coverage (born between 1981 and 1990) every four to five years. In 1995-6, 11,680 cases of mumps were reported, most of them amongst this birth cohort living in north east of the Czech Republic. The same cohort was also affected in 2002-3, this time in the south-east of the Czech Republic. Cross border movement through the Austrian and Polish frontiers could partly explain the uneven geographical distribution of the cases as vaccination coverage in these countries is considerably lower than in the Czech Republic. Austria reported less than 80% and Poland less than 40% vaccination coverage in 2003 and similar figures for previous years.

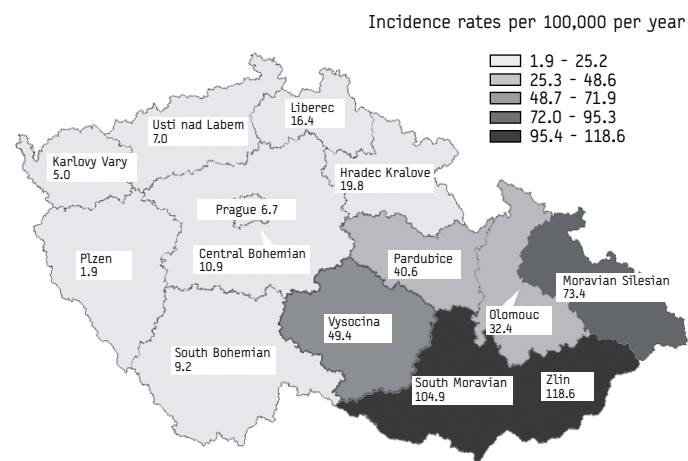
TABLE 2

Number of mumps cases and average annual incidence rates per 100,000 population, by region, Czech Republic, 1 January 2005 – 30 June 2006 (n=5,998)

Region (name in Czech, main town)	Incidence per 100,000 population/year	Number of cases
Prague, (Praha)	6.7	117
Central Bohemian (Stredocesky, Prague)	10.9	184
South Bohemian (Jihocesky, Ceske Budejovice)	9.2	86
Plzen (Plzensky, Plzen)	1.9	16
Karlovy Vary (Karlovarsky, Karlovy Vary)	5.0	23
Usti nad Labem (Ustecky, Usti nad Labem)	7.0	86
Liberec (Liberecky, Liberec)	16.4	105
Hradec Kralove (Kralovehradecky, Hradec Kralove)	19.8	163
Pardubice (Pardubicky, Pradubice)	40.6	309
Vysocina (Vysocina, Jihlava)	49.4	384
South Moravian (Jihomoravsky, Brno)	104.9	1,767
Olomouc (Olomoucky, Olomouc)	32.4	310
Zlin (Zlinsky, Zlin)	118.6	1,056
Moravian-Silesian (Moravskoslezsky, Ostrava)	73.4	1,392
Czech Republic	39.2	5,998

FIGURE 3

Average annual incidence rates of mumps per 100,000 population, by region, Czech Republic, 1 January 2005 – 30 June 2006



[5] Given the periodicity of outbreaks within this specific cohort, one recommendation is to conduct catch-up vaccinations for all of those within the cohort, throughout the country, regardless of vaccination status. Overall, a national intervention strategy that has multiple elements is required to decrease the rate of accumulation of susceptible people within the population.

Our estimation for the economic burden of this mumps outbreak is likely to be an underestimate, as it does not take into account the costs to the health service, or the societal costs within communities. Cases with complications were not included in our calculations, either. A more detailed economic study will inform policy makers of the burden of a mumps outbreak of this size. As the most affected cohort ages, the costs of productivity loss will continue to rise, hence a mass vaccination campaign within this cohort could save costs in the future.

As a result of this outbreak, a voluntary vaccination offer was advertised in the Moravian regions (east of the Czech Republic) and subsequently in the whole country. Males aged 15-25 years were targeted, to decrease the impact of complications, but were required to pay for the vaccination themselves. It is not known how many people responded to this campaign, so it is not possible to evaluate the effectiveness of this control measure. However, the number of cases reported to Epidat after the period described returned to the expected range, indicating that the outbreak had ended.

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