AN OUTBREAK OF MUMPS IN SWEDEN, FEBRUARY-APRIL 2004

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Between 24 February and 26 April 2004, Västra Götaland county in Sweden reported 42 cases of suspected mumps. A descriptive study of the cases was undertaken. A questionnaire was administered by telephone and vaccine effectiveness was calculated using the screening method. Seventy four per cent (31/42) of the suspected cases were interviewed by telephone. Eight out of the 42 serum samples were positive or equivocal for mumps IgM by ELISA. Mumps virus genome was identified in 21/42 (50%) saliva samples. Eleven were selected for sequencing and all were confirmed to be mumps virus. Cases were predominantly from 2 small towns. Eighteen out of 19 cases that developed bilateral swelling could be linked to one small town. The median age of interviewed cases was 43 years (range 5 to 88). Six cases were admitted to hospital, 5 of which were older than 30 years. The highest incidence occurred in the 35 to 44 years age group. Vaccine effectiveness was estimated to be 65% for 1 dose and 91% for 2 doses.

This descriptive study shows the increasing age of mumps cases with increasing vaccine coverage. Vaccine effectiveness was particularly high for 2 doses. Second-dose uptake must be ensured, as primary vaccine failure is well documented in mumps. Stronger precautions must be taken to avoid pools of susceptible older individuals accumulating due to the increased risk of complications.

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Introduction

Mumps is an acute viral disease, of which the commonest symptom is painful swelling of one or both parotid glands. Mumps in childhood tends to be mild and around 30% of infections are asymptomatic [1,2]. Transmission occurs through inhalation of respiratory droplets or by direct person-to-person contact.

Vaccination against mumps in Sweden began in 1982 with the introduction of combined mumps, measles and rubella (MMR) vaccine in the national immunisation programme at 18 months and 12 years. Coverage rates quickly exceeded 90% and have been kept at this level for the past 20 years [3]. The annual incidence of mumps in Sweden was about 435 cases per 100 000 in the pre-vaccine era (1977-1979), and dropped to less than 1 per 100 000 in the post-vaccine era (1993-1995). This represented a reduction of more than 99%.

Mumps is a notifiable disease in Sweden. Between 24 February and 26 April 2004, Västra Götaland county reported 42 suspected cases of clinical parotitis. This number of cases was well above expected for this county (about 10 cases per year) and most were in adults. The Department of Epidemiology at the Swedish Institute for Infectious Disease Control (SMI) was invited by the County Medical Office to investigate the outbreak. The aims were to describe the outbreak, identify any risk groups as well as complications and evaluate vaccine effectiveness.

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Methods

Case finding and definition

All physicians in the area were requested to report suspected mumps cases. A description of the outbreak was also posted in EPI-aktuellt (the weekly national epidemiological bulletin published by SMI) with a request for further cases to be notified. A probable case was defined as painful swelling of one or more salivary glands for at least 2 days; occurring after 10 February 2004 in a person who either lived or worked in Västra Götaland between 1 February and mid-April 2004. A confirmed case was defined as the above plus serological confirmation of IgM mumps antibodies and/or isolation of mumps virus genome in saliva by PCR.

Questionnaire design and administration

A questionnaire was developed and administered by telephone, asking for case age and sex, place of work or study, household members (age and profession/school), recent travel, drugs taken, allergies, vaccination status, symptoms/complications, possible contacts and previous mumps-like illness.

Laboratory methods

Mumps-specific IgM (inhouse ELISA and Behringwerke, Germany) and IgG (Behringwerke, Germany) were detected in serum by ELISA. Mumps virus RNA was extracted from saliva samples using QIAamp RNA extraction kit (Qiagen). The extracted RNA was reverse transcribed to cDNA using Superscript III reverse transcriptase and random primers. The cDNAs generated were amplified in two consecutive PCR reactions (nested PCR) using Platinum Taq DNA Polymerase (Invitrogen) and two sets of primers specifically for conserved regions of the nucleocapsid gene. Primers used for the nested PCR were: mumps-of 5'AGTGTACTAATCCAGGCTTG 3' and mumps-or 5' ACCCACCATTGCATAGTATC 3' for the first round of PCR and the primers mumps- if 5' GTATGACAGCGTACGACCAAC and mumps-ir GATAGGAACCCCTGCCGTCT 3'for the second round of PCR. The nested PCR amplificates were analysed by agarose gel (2%) electrophoresis and bands of about 220 base pairs were considered positive for the nucleocapsid gene. Eleven out of 22 of the PCR positive products were verified by DNA sequence analysis and were shown to be mumps virus when compared with published sequences in GenBank.

Vaccine effectiveness

Patients or parents of patients were questioned about their mumps vaccination status. Vaccine effectiveness (VE) was calculated for individuals aged less than 24 years (who would have been included in the vaccination programme started in 1982) using the screening method [4,5,6,7,8]. The formula of VE is VE = (PPV-PCV)/(PPV*[1 PCV]), where PPV equals the proportion of the population vaccinated and less than 24 years of age and PCV equals the corresponding proportion among cases. A seroprevalence survey for vaccine preventable diseases was undertaken in Sweden in 1997 [9]. This provided a background rate of natural immunity in the population and was used in certain denominator calculations. Vaccine coverage rates were obtained from Statistics Sweden (SCB).

Results

Laboratory findings, response rate and case classification

Forty two suspected clinical cases were reported by Västra Götaland county. Serological analysis indicated that 8 of 42 samples were positive or equivocal for mumps IgM. PCR identified mumps virus genome in 21 of 42 (50%) saliva samples. In total, 22 cases were either positive for mumps IgM or mumps virus genome was identified. In total, 31 patients (74%) were interviewed (11 patients were therefore not interviewed, despite repeated phone calls). According to our case definition, 17 cases were defined as probable and 14 as confirmed.

Symptoms and admission to hospital

All 31 patients had parotitis: 19 patients (61%) reported bilateral swelling, 11 patients (35%) unilateral swelling and 1 reported swelling but information on symmetry was missing. 11 patients (35%) had fever, 19 patients (61%) reported pain in the parotid area, 12 patients (39%) headache and 6 patients (19%) reported dryness of the mouth. The reported complications were orchitis in 1 case. Five out of 6 patients who were admitted to hospital were unvaccinated and over 25 years old. Twenty patients (all unvaccinated) indicated that they had had mumps in the past (median age=52 years, range 34 to 88), 9 patients (7 vaccinated patients) indicated that they had not had mumps (median age=20 years, range 5 to 50) and 2 patients (1 vaccinated patient) did not know.

Age and sex distribution

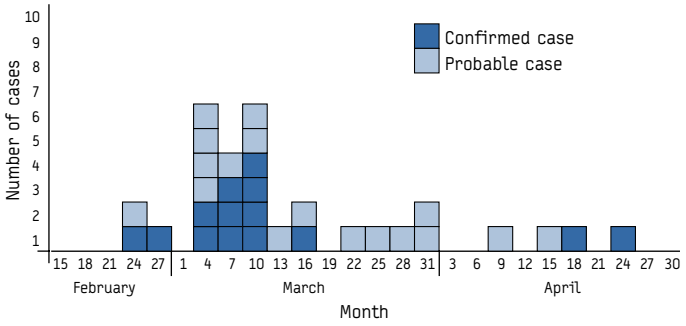
Overall median age was 38.3 years (range 5 to 88) and 23 (55%) patients were female. The median age of the 31 interviewed patients was 43 years (range 5 to 88) and 25 out of 31 were 24 years or older. Median age of those not interviewed (n=11) was 21 years (range 5 to 76). The 35 to 44 years age group had the highest incidence (2.87 / 10 000) followed by the 25 to 34 years age group (2.32 / 10 000). Incidence decreased with older age groups.

Epidemic curve

Figure 1 shows the epidemic curve for this outbreak. The first cases were reported on 24 February 2004 with the majority reporting onset of symptoms between 4 and 11 March 2004. Thereafter, the number of cases decreased steadily.

FIGURE 1

Epidemic curve showing date of onset (by 3-day interval) of illness, 2004, Sweden

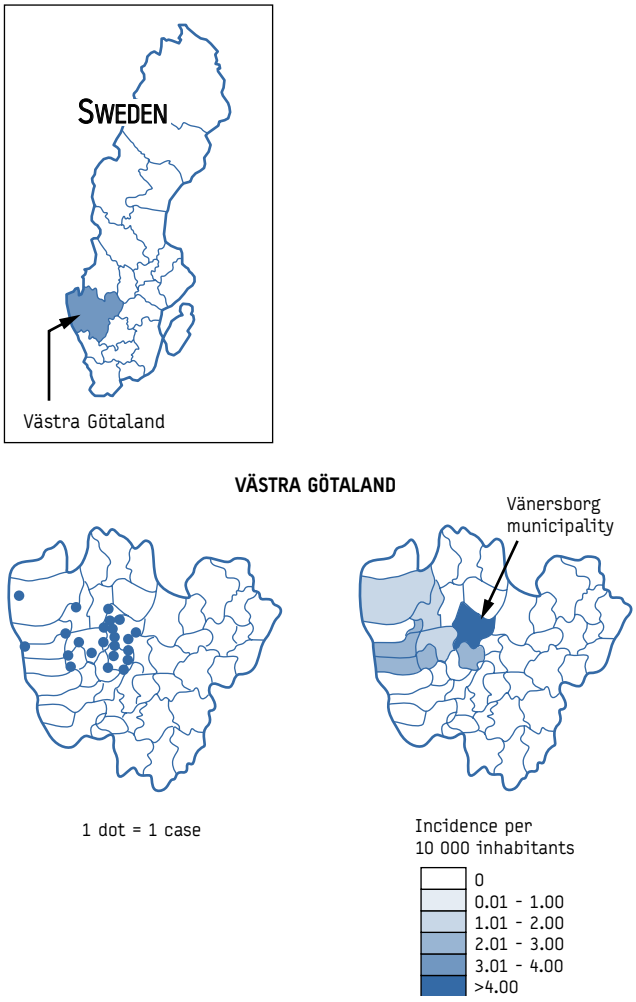


Geographical distribution

While the outbreak did spread to other municipalities in Västra Götaland county, it was not particularly widespread, nor did it appear to show any distinct pattern of spread over time. Figure 2 shows that the distribution and incidence of cases was very limited geographically and temporally. Vänersborg municipality had the highest incidence (4.05 per 10 000) and a significantly higher risk (RR=4.86; 95% CI: 1.77-13.36) when compared to municipalities with only 1 case.

FIGURE 2

Dot density (n=31) and incidence map of mumps outbreak by municipalities in Västra Götaland County, Sweden, 2004



Vaccine effectiveness

All 6 patients under 24 years old indicated that they had been vaccinated against mumps at least once. Among patients older than 23 years, 2 indicated that they had been vaccinated. VE (ascertained by self-reported immunisation status) was 65% for 1 dose and 91% for 2 doses. Patients with unknown vaccination status (n=7) or unknown dosage (n=1) were excluded in the calculation of VE, as recommended [10].

Discussion

This study illustrates the impact of the vaccination programme: higher median age of mumps cases with increasing vaccine coverage. The outbreak's greatest effect was on age cohorts (particularly 35-44 years) that were not included in existing vaccination programmes and that had had fewer opportunities to acquire natural infection. The slightly lower incidence in the 25-34 years age group is because many in this group were vaccinated, although they were not the right age to be included in the vaccination programme when it started [9]. The incidence decreased with age due to acquired immunity. Large numbers of unvaccinated and susceptible adults were probably being exposed to circulating virus in schools through their children (many adult patients indicated that they had children at home). Similar outbreaks in individuals too old to receive the MMR vaccine have been observed in the United Kingdom in 2004, particularly in students aged 14-22 years [10].

Several limitations are recognised in this study. Firstly, due to the nature of the investigative response, this study did not include a control group needed to make more conclusive findings. Secondly, vaccination status of cases in this study relied upon self-reported status and was not confirmed. The small number of vaccinated individuals also makes the VE estimate imprecise. Thirdly, individuals not interviewed had a lower median age. If it is the case that a high proportion of these non-interviewed patients have been vaccinated, then it is likely that the VE estimated here is too high. Lastly, up to 30% of mumps infections can be asymptomatic. Subclinical cases would therefore have been missed and their role in the transmission of the virus in these communities cannot be assessed. This problem needs to be addressed if future contact tracing is to be more successful in person-to-person outbreaks involving infectious agents with a high asymptomatic rate.

The screening method will indicate whether there is a need for more careful evaluation, and should not be relied upon for precise estimation of VE [11]. We infer that the VE was high, particularly if the person had indicated having received 2 doses. Five out of seven vaccinated patients indicated only having received 1 dose of MMR vaccine. Secondary vaccination must be ensured, as primary vaccine failure with mumps is well documented [12]. There also appeared to be more severe illness in older, unvaccinated individuals. We recommend using the data obtained from the seroprevalence surveys conducted in Sweden every 5 years, to check that pools of susceptible older individuals are not accumulating due to the increased risk of complications.

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