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Mumps outbreak among vaccinated university students associated with a large party, the Netherlands, 2010

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ABSTRACT

We investigated a mumps outbreak within a highly vaccinated university student population in the Netherlands by conducting a retrospective cohort study among members of university societies in Delft, Leiden and Utrecht. We used an online questionnaire asking for demographic information, potential behavioural risk factors for mumps and the occurrence of mumps. Vaccine status from the national vaccination register was used. Overall, 989 students participated (20% response rate). Registered vaccination status was available for 776 individuals, of whom 760 (98%) had been vaccinated at least once and 729 (94%) at least twice. The mumps attack rate (AR) was 13.2% (95%CI 11.1–15.5%). Attending a large student party, being unvaccinated and living with more than 15 housemates were independently associated with mumps ((RR 42 (95%CI 10.1–172.4); 3.1 (95%CI 1.7–5.6) and 1.8 (95%CI 1.1–3.1), respectively). The adjusted VE estimate for two doses of MMR was 68% (95%CI 41–82%). We did not identify additional risk factors for mumps among party attendees. The most likely cause of this outbreak was intense social mixing during the party and the dense communal living environment of the students. High coverage of MMR vaccination in childhood did not prevent an outbreak of mumps in this student population.

1. Introduction

The Netherlands introduced mumps vaccination into the National Immunisation Programme in 1987 using the measles, mumps and rubella vaccine (MMR). The MMR vaccine used contains the Jeryl-Lynn mumps virus strain and is administered in a two-dose schedule at 14 months and nine years of age. Nationally, the MMR vaccination coverage at 10 years of age for the second MMR dose has been consistently above 90% since the programme's inception [1]. Nevertheless, in recent years the Netherlands has experienced localised outbreaks of mumps: in 2004 (genotype G5) among students at an international university of hospitality management (105 cases reported, of whom 62 of 64 (97%) with known vaccination status were vaccinated with a least one MMR dose) [2]; and between 2007 and 2009 in the so-called Bible Belt (genotype D4) [3], an area traditionally associated with low vaccine uptake and outbreaks of vaccine-preventable diseases [4–6]. Whereas the occurrence of mumps in communities religiously opposed to vaccination can be anticipated, mumps in highly vaccinated adult populations is concerning and warrants investigation, particularly as the rate of certain complications of mumps increases with age [7].

Mumps became a notifiable disease in the Netherlands in December 2008. From 1 December 2009 to 20 April 2010, 172 mumps cases were notified to municipal health authorities across the country, a marked increase from the 65 cases notified in the eleven preceding months in 2009. Seventy-nine cases were notified to Municipal Health Service (MHS) Zuid-Holland West (including the city of Delft), 44 were notified in the Leiden region (MHS Hollands-Midden), 11 were notified to MHS Utrecht and 38 were notified in other regions across the country. The majority of cases (70%; $n = 114/164$ cases with known vaccination status) had received at least one dose of MMR. Overall, 65% of cases ($n = 112$) were students, of whom 27 (24%) reported having attended at least one evening of a large four-day party in Leiden (23–26 February,

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week 8). This party was organised and hosted by students in nine rooms spread across several floors of a members-only student association building. It was attended by 1175 Leiden students and 1850 students from other cities. The majority of cases reported to MHS Hollands-Midden occurred in week 11, one incubation period after the party, further implicating the event as a source of transmission, described in earlier communication about this outbreak [8].

Outbreaks of mumps in educational settings such as schools and colleges have been previously reported [9–12]. Explanations for this include the close contact environment that facilitates transmission and possibly a particular susceptibility for mumps in adolescents who were vaccinated in childhood [12,13]. The 2009–2010 mumps outbreak in a highly vaccinated student population provided an opportunity to assess risk factors for mumps in this population and to investigate factors associated with mumps vaccine failure among vaccinated party attendees.

2. Methods

We conducted a retrospective cohort study among students from the three university cities most affected by the outbreak: Delft, Utrecht and Leiden. Within these cities the study was restricted to student associations invited to the party in Leiden to permit investigation of party-related risk factors. Student associations in the Netherlands are similar to North American fraternities and sororities in that membership is applied for and approved after an initiation period. Members have close social ties: they typically live together and social events are frequently organised and attended by members only. Each of the eight student associations of this type in the Netherlands hosts a three- or four-day party once a year which is open to members of the other associations. In May 2010, all 4988 members of the four selected student associations in Delft (n = 356 women; n = 1044 men), Leiden (n = 1400; sex breakdown of members not provided but estimated by society to be an approximately equal sex ratio) and Utrecht (two societies: n = 1288 women; n = 900 men) were invited to the study by email. Invitation and reminder emails (sent one week later) were circulated via the society's mailing list and contained a link to the online questionnaire (Questback, Oslo, Norway).

To investigate risk factors associated with mumps among these student associations the questionnaire asked about demographic characteristics including current living arrangements, MMR vaccination history, and history of mumps infection. Informed consent was sought to verify MMR vaccination status using the national vaccination register. A case was defined as a student with self-reported mumps (swelling of one or both cheeks with symptoms lasting at least two days) since 1st September 2009. To investigate risk factors associated with vaccine failure among vaccinated party attendees, additional information was requested from party-attendees; specifically, the day(s) of party attendance, locations visited at the party (from a list of nine rooms or areas within the student association including several bars, themed rooms with DJs and two smoking rooms), contact with shared items including food, drinks and cigarettes, and close personal contact (kissing) during the party or at an after party.

Questionnaire responses were downloaded from the password-protected website and imported to STATA 10 for analysis [14]. Individuals with a history of mumps prior to September 2009 (n = 13) or whose MMR vaccination status could not be determined from the vaccine register (n = 30) were excluded from the analysis. Associations between risk factors and self-reported mumps were first explored in univariable analysis. Variables with a p-value <0.25 (from the univariable analysis), as well as age and sex, were entered into the multivariable regression model. When we found evidence of collinearity among explanatory variables we selected the variable which gave the best model fit (based on the Bayesian Information Criterion – BIC) into the final model. We estimated vaccine effectiveness (VE) as 1 minus the relative risk (RR) (VE = 1-RR), using the adjusted RR for mumps in vaccinated compared to unvaccinated participants.

Persons who were not susceptible to mumps at the time of the party (mumps with date of onset prior to the minimum incubation time of 12 days after the first day of the party (23rd February)) were excluded from the analysis of party-related risk factors associated with mumps failure. Cases arising after the maximum incubation time (25 days after the last day of the party (26th February)) were included as non-cases so risk factors associated with the party could be investigated.

3. Results

3.1. Study population

Overall, 989 individuals responded to the questionnaire (response rate = 20%; 10% among male students, 31% among female students) and reported studying in Delft (n = 212), Utrecht (n = 517) or Leiden (n = 195). For 65 respondents, the city of study was not available. Respondents were aged between 17 and 28 years (median age 21 years) and were predominantly female (75%; n = 738). The median age of the invited population of society members in these cities was also 21 years, 47% were female.

MMR vaccination status was verified for 91% (776/853) of consenting survey respondents: 94% (n = 729) had received two doses of MMR vaccine, 4% (n = 31) were vaccinated with one dose of MMR and 2% (n = 16) had never been vaccinated with MMR (Table 1).

Overall, 946 of the 989 survey respondents answered questions about mumps disease, of whom 125 reported having had mumps (attack rate 13.2%, 95%CI 11.1–15.5%). Half the cases (54%) reported visiting their GP, of whom seven were diagnosed with complications, specifically meningitis (1; 0.8% of cases), pancreatitis (2; 1.6%), orchitis (3; 8% of male cases) and deafness (4; 3.2%). One additional individual was admitted to hospital for one night due to the severity of symptoms but had no complications.

Date of symptom onset ranged from 25th December 2009 to 1st June 2010 (n = 110) (Fig. 1). The number of cases peaked in mid-March (week 11), about one incubation period [15] after the party.

3.2. Risk factors associated with mumps

The attack rate among men was higher than among women (17% vs. 12%, p = 0.06). Age-specific attack rates, did not significantly differ (p = 0.12) and there was no difference in the mean number of years since last vaccination between cases

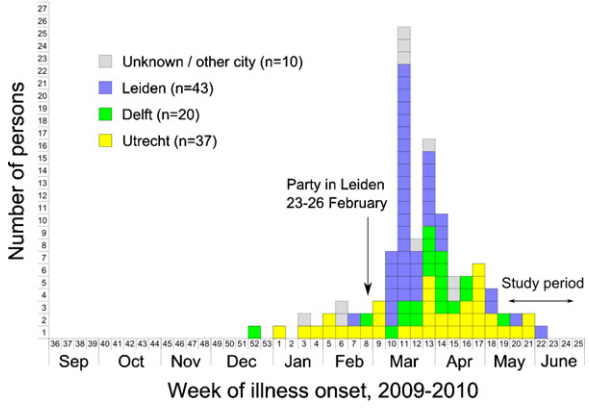

Fig. 1. Epidemic curve showing the number of mumps cases by week of symptom onset and city of study, December 2009–June 2010, the Netherlands (n = 110).