ABSTRACT

In early 1997 an unexpectedly high number of cases of mumps was reported in Vancouver, British Columbia. *Methods:* A case control study was conducted to address four objectives: 1) Describe the outbreak and the population at risk, 2) examine the impact of mumps on this population, 3) identify personal risk factors for infection, and 4) test the hypothesis that social gatherings, 'rave' parties in particular, were a risk factor in this outbreak. *Results:* Mumps infection was associated with: attending a rave party [OR = 17; 95% CI: 2.7-710], residing in Vancouver [OR = 3.7; 95% CI: 1.4-10], and contact with a person with mumps [OR = 13; 95% CI: 2-552], during the 'exposure' period. Vaccine effectiveness, ascertained by self-reported immunization status, was 80% [95% CI: 29%-96%]. *Conclusions:* Attendance at rave parties was associated with mumps infection during this outbreak. Many persons aged 17-40 may remain susceptible to mumps; in BC these persons are eligible for one dose of MMR and should be encouraged to be vaccinated.

ABRÉGÉ

Au début de 1997, un nombre étonnamment élevé de cas d'oreillons a été signalé à Vancouver, en Colombie-Britannique. Une étude cas-témoins a été réalisée pour permettre d'atteindre quatre objectifs: 1) décrire l'écllosion et la population à risque; 2) examiner les effets des oreillons sur cette population; 3) déterminer les facteurs de risque individuels associés à cette infection; et 4) vérifier l'hypothèse selon laquelle les rencontres sociales, les parties 'rave' surtout, étaient un facteur de risque dans cette écloison. *Résultats:* Les oreillons étaient associés : à la participation à un party rave [RC=17; IC à 95 % : 2,7-710], au fait de résider à Vancouver [RC=3,7; IC à 95 % : 1,4-10] et à des contacts avec une personne atteinte des oreillons [RC=13; IC à 95 % : 2-552], au cours de la période d'exposition. L'efficacité vaccinale, vérifiée par le statut vaccinal déclaré par les intéressés, était de 80 % [IC à 95 % : 29 %-96 %]. *Conclusions:* La participation à des parties 'rave' était reliée aux cas d'oreillons observés au cours de cette écloison. Bon nombre de personnes âgées de 17 à 40 ans peuvent demeurer réceptives aux oreillons. En C.-B., ces personnes sont admissibles à une dose du vaccin RRO, et devraient être encouragées à se faire vacciner.

An Outbreak of Mumps Among Young Adults in Vancouver, British Columbia, Associated with 'Rave' Parties

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Mumps is an acute viral disease caused by *Paramyxovirus*. A universal single dose Measles-Mumps-Rubella (MMR) immunization program was introduced in British Columbia (BC) for children aged 12 months and over in 1981. Therefore in the spring of 1997, persons aged 1 to 16 had been eligible for childhood MMR vaccination in BC, while adults aged 17 and older had no childhood vaccination program available to them. Adults aged over 40 years were likely to have had mumps as children.¹

Between 1992 and 1996 the majority of reported cases of mumps in BC were among the largely immunized school-aged population (73% were under age 15 years). The mean annual number of cases of mumps reported in all BC in 1992-96 was 53, with only one or two cases reported in Vancouver. In January and February 1997, more than 20 cases of mumps were reported in Vancouver. The health board notified Vancouver physicians during the week of February 26, 1997, of an outbreak of mumps, and a press release with public information about the outbreak was issued on March 3, 1997. The cases were noted to be young adults and during routine public health follow-up, some volunteered

that they had attended 'rave' parties. Rave parties are large gatherings in warehouse-type venues where young adults dance to electronic music and share drinks and water bottles. The Vancouver/Richmond Health Board (V/RHB) and the BC Centre for Disease Control conducted a study to address the following four objectives:

- Describe the outbreak and the population at risk;
- Examine the impact of mumps in this population;
- Identify personal risk factors associated with mumps infection; and
- Test the hypothesis that social gatherings, rave parties in particular, were a risk factor in this outbreak.

The first and second objectives were addressed by a case review and review of the Communicable Disease Surveillance System (CDSS) database. CDSS is the electronic database of communicable disease cases reported to Medical Health Officers in BC. The third and fourth objectives were addressed by a case control study.

METHODS

Cases were identified using CDSS. We included both clinical and laboratory confirmed cases. The CDSS clinical case definition of mumps is an illness characterized by acute onset of fever with unilateral or bilateral tender, self-limited swelling of the parotid or other salivary gland, lasting ≥ 2 days without other apparent cause. A confirmed case had a non-equivocal IgM positive result taken at least 4 days after salivary gland swelling onset.

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Cases included in the study were persons with clinical or laboratory confirmed mumps with an onset of illness between January 1 and March 26, 1997. Some health regions may have removed clinical cases from the CDSS when a non-reactive result was obtained. To reduce selection bias, cases with a non-reactive IgM result taken 4 days or more after salivary gland swelling onset were excluded regardless of clinical symptoms or link to confirmed cases.

Two groups of controls were used:

'Random controls' were used to explore geographic factors. Random controls were contacted using a listing of randomly selected residential BC telephone numbers supplied by the Dominion Telephone Company. Random controls were divided into 3 broad age groups: 16 years and under (corresponding to those for whom a universal Measles-Mumps-Rubella (MMR) immunization program was available in BC in childhood), 17 to 39 years, and 40 years and over (likely to have had mumps as children). The interviewers worked consecutively through printed sheets of random telephone numbers and asked to speak to the person in the household or family in the age group being sought. If more than one person was in the age group, the person whose birthday occurred next was selected. The telephone number was excluded if: 1) no English was spoken, 2) contact had not been achieved after 3 attempts, 3) no person was in the appropriate age group, 4) the person interviewed reported a past history of mumps, or 5) the person declined to be interviewed.

'Physician-matched controls' were used as a proxy for geographic and social demographics to assess personal risk factors. Physician-matched controls were identified by the case's 'usual' physician. Up to three attempts were made to contact each physician's office requesting five names and phone numbers of patients who were the same gender and whose age was within one year of the case's age. The method that a physician was to use in selecting a control was not specified. Where controls were not provided by the case's usual physician, they were obtained from other participating physicians or from physicians in a similar geographic location as identified in the

Figure 1. Reported incidence of mumps in outbreak period (Jan. to Mar. 1997) compared to 1992-1996, and May-Oct. 1997 by place of residence.

Figure 2. Cases identified by BC CDSS

Figure 3. Epidemic curve of reported mumps cases by onset date and place of residence, British Columbia, 1997.

medical directory of the College of Physicians and Surgeons of BC.

A questionnaire was developed and pretested on male and female volunteers, 4 aged 17 to 26 years, 1 aged under 16 years

and 1 aged over 30 years. Verbal consent was obtained from cases and controls, and from parents of any person aged under 16 years interviewed. A parent could answer on behalf of the child if they so chose.

TABLE I
Rates of Mumps Incidence in BC and # of Study Cases by Birth Cohort Groups

Birth Cohort	Age in 1997	Ecologic Immunization Status	Rate* 92-96	Rate* Out-break	Incidence Rate Ratio Outbreak: 92-96	Study Cases # (%)
1981-96	1-16	Eligible for childhood MMR vaccination in BC	3.35	6.41	1.9:1	10 (20)
1971-80	17-26	No childhood vaccination program: Partially susceptible	1.67	32.7	19.6:1	25 (50)
1957-70	27-40	No childhood vaccination program: Partially susceptible	0.35	6.51	18.8:1	14 (27)
< 1957	40+	Probable natural immunity	0.18	0.74	4.0:1	2 (4)

* Rates/100,000 person-years.

TABLE II
Risk Factors for Physician-matched Controls

Risk Factor	Odds Ratio	95% CI
Contact with person with mumps	13	2 - 552 *
Self-reported mumps immunization	0.2	0.04 - 0.71 *
Attending education establishment	0.56	0.15 - 1.9
Attending bars	1.3	0.41 - 4.7
Attending clubs	1.8	0.54 - 7
Attending raves	17	2.7 - 710 *
Play group sports	0.43	0.13 - 1.2
Attending concerts	0.67	0.06 - 6
Other social events	0.38	0.12 - 1

* Indicates statistically significant finding

Immunization history was obtained by self or proxy report. To confirm the validity of reported immunization, 6 control family physician offices were contacted.

Cases and controls were asked about potential exposures during work, school attendance, location and social activities in an 'exposure period'. For cases, the exposure period was a two-week period beginning 25 days prior to the onset of symptoms. Random controls were frequency-matched to cases by broad age group and two-week exposure periods commencing the closest Monday to the beginning of a case exposure period. Physician controls were matched 1:1 with the cases and asked about the exact exposure period of the case.

Cases were asked about symptoms and extra-salivary manifestations of mumps, physician visits and missed activities during the 'illness period' of the two weeks commencing the date of salivary swelling onset. Both sets of controls were asked about symptoms in the two weeks immediately prior to the interview.

Statistical methodology

Data entry and statistical analysis were performed using Epi Info (version 6.4, Centers for Disease Control and Prevention, USA). Random controls were examined using Mantel-Haenszel summary odds ratio for the stratified data. Logistic regression (EGRET) analyses were performed to evaluate the impact of the non-randomly assigned exposure period for the random controls; the odds ratios did not differ (data not shown). Physician controls were examined using Mantel-Haenszel matched odds ratios.

RESULTS

Description of the outbreak and the population at risk

Using the 1996 population census data for BC and the CDSS database, the reported incidence rate of mumps in BC increased from the 1992-96 baseline of 1.4 to 8.4 cases /100,000 person-years in January to March 1997 (incidence rate ratio=6.2). The corresponding increase in

Vancouver was from 0.2 to 27.8/100,000 person-years (incidence rate ratio=126). In a six-month period following the outbreak, the incidence rate of mumps in Vancouver had returned to its pre-outbreak baseline (Figure 1).

The incidence rate of mumps by birth cohort was calculated for 1992-96 and for January to March 1997 (see Table I). The incidence rate of mumps increased during the outbreak in all age groups, but especially in the 17 to 26 and 27 to 40 year age groups (>18-fold increase).

Eighty-one cases were reported to the CDSS between January 1 and March 26, 1997 (Figure 2). Thirty cases were excluded: 18 had a non-reactive IgM (samples taken at least 4 days after symptom onset), 2 had symptom onset prior to January 1, 1997, 5 did not meet the case definition for other reasons, and 5 could not be contacted. Descriptive analysis was performed on 51 cases: 26 cases (51%) were male; 27 cases (54%) resided in Vancouver; 1 case included in the case review was excluded from the case-control analyses because her onset of symptoms occurred within one incubation period after household contact with another case. Eighteen physicians did not provide controls; 15 controls were obtained from other physicians in similar geographic areas, thus 3 cases remained unmatched and were not included.

The epidemic curve of the 51 cases is shown in Figure 3. Thirty of the 51 cases (59%) were 'laboratory confirmed' by a reactive IgM. Another 5 had serology performed but were not confirmed (2 results were equivocal, 2 were taken less than 4 days after symptom onset, and 1 result could not be traced); 16 did not have serology performed. Four of the 10 cases aged 0-16 years were unimmunized.

Impact of mumps

Case persons reported their mumps symptoms lasting from 1 to 25 days with a median of 9 days. Severe headache was a common symptom reported by 24 (47%). Seven males (27% of all males and 33% of males over 16 years of age) reported testicular pain. Physicians diagnosed 8 cases (16%) of thyroiditis, 4 cases (15% of all male cases) of orchitis and 2 cases (4%) of pancreatitis. The

median number of visits by cases to a physician was 2.

Regular daily activities were hampered in 86% of the cases (compared to 13% of physician matched controls and 14% of random controls).

Personal risk factors associated with mumps infection

When analysis was performed using the randomly selected controls, residing in Vancouver during the exposure period was significantly associated with illness [OR = 3.7; 95% CI: 1.4-10].

Results of the analysis using physician-matched controls are shown in Table II. Contact with a person with mumps, during the exposure period, was significantly associated with being reported as a case [OR = 13; 95% CI: 2-552]. Reported previous mumps immunization had a protective vaccine effectiveness, ascertained by self-reported immunization status, of 80% [95% CI: 29%-96%]. The validity of reported mumps immunization could not be determined; none of the 6 control physicians contacted had the subjects' immunization details available.

Social gatherings, rave parties in particular, as a risk factor

Attending a rave party was the factor most strongly associated with mumps infection [OR = 17; 95% CI: 2.7-710]. All persons who attended raves reported that they shared drinks and danced in close proximity. Other social gatherings and activities where close contact occurred with at least 10 people were not associated with mumps, nor was attendance at an educational institution.

DISCUSSION

The reported incidence rate of mumps was increased in all birth cohorts during the outbreak period (January to March 1997), compared to the rates of the previous 5 years. The number of mumps cases reported on CDSS underestimates the true incidence of mumps. Subclinical cases of mumps are frequent; about one third of susceptible persons who have contact with a mumps case develop inapparent (subclinical) infection.² In this outbreak, most cases

(77%) were among those 17 to 40 years of age, compared with the previous 5 years (1992-96) when most reported cases of mumps (73%) were in persons under 15 years of age. Recent outbreaks of mumps disease in the US have been reported in the highly immunized school-aged population.³⁻⁵ However, the age of cases in this outbreak was older; 77% were aged 17 to 40 years.

Attendance at rave parties was the most important risk factor for mumps infection in this outbreak. Participation in one or more rave parties was also identified as a common factor in a spatio-temporal cluster of *N. meningitidis* infections in Quebec in 1996.⁶

The rate of reported extra-salivary gland complications among the 51 cases is similar to that reported in the literature. Pancreatitis, usually mild, occurs in 4% of cases and orchitis in 20-30% of postpubertal males.¹ In this study, 2 cases (4%) reported physician-diagnosed pancreatitis and 33% of males over 16 years reported testicular pain.

This study has a number of limitations. Selection bias may have occurred as physician controls were obtained only from physicians willing to participate and no instructions were given on how to select controls. Recollection of mumps infection indicates immunity with a positive predictive value greater than 95%.⁷ However the control's mumps status was not assessed by serology and some may have had previous subclinical infection. Reporting bias may have occurred as persons who recently had mumps disease may be less likely to report previous mumps disease or immunization than controls. Pretesting of the questionnaire indicated that controls had poor recall of symptoms and of activities they may have missed three months prior to the interview. To minimize reporting bias, the 'illness period' for both sets of controls was defined as the two weeks immediately prior to the interview.

Reported mumps vaccination had 80% protective vaccine effectiveness. However, the accuracy of reported mumps vaccination was not confirmed. A single dose MMR immunization was introduced in BC in 1981 for children aged 12 months, with no organized 'catch up' program for

older children. In April 1996, a second dose of MMR was introduced in the BC childhood immunization schedule at 18 months of age. Most adults born before 1957 are likely to have been naturally infected in childhood, even without a clinical history of mumps disease.⁸

In conclusion, attending a rave party or knowing someone with mumps were the two most important risk factors associated with mumps infection in this outbreak; large numbers of young adults attend raves where they dance and share drinks and water bottles. Immunization provides substantial protection. Persons born after 1957 may remain susceptible to mumps if they are not immunized. These persons are eligible for at least one dose of MMR and should be encouraged to obtain it.

ACKNOWLEDGEMENTS

The authors thank the following for their cooperation and assistance: J. Bowering, E. McCann, C. Semturis, D. Turner, B. Waldie, S. Weatherill, M. Williams, V/RHB; F. Azzadin, BCCDC; and D. Werker, LCDC, Ottawa, ON.

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Received: June 15, 1998

Accepted: November 25, 1998