

# **Epidemiology & Public Health Bulletin**

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## **An Epidemiological Survey of Mumps in a Kindergarten in Kaohsiung**

### **1. Introduction**

A 19 November 1995 report by one of the sentinel physicians in Kaohsiung City on seemed to indicate some aggregation of mumps in a kindergarten there. The present survey was conducted to see if the aggregation would develop into an outbreak.

Mumps (infectious parotitis) is an acute infectious disease caused by a virus of the paramyxovirus group. It occurs more often among pre-school and school-age children of four to five old. Once infected, the individual develops life-long immunity. The source of infection exists in the saliva of infected or inapparent persons. Communicability from saliva ranges from 6 to 14 days before and after the swelling of the parotid glands. Transmission is carried out primarily by droplet spread and direct contact with the saliva of an infected person. The incubation period is from 12 to 25 days. Symptoms include: swelling of one or both of the parotid glands, abdominal pain, fever, headache and mild respiratory symptoms. Orchitis occurs in 20-35% of males and oophoritis in some females who contract the disease during puberty. Changes in thyroid, pancreas and other organs may also occur. Complications of the nervous system such as meningitis, encephalitis and loss of hearing are rare<sup>(1-2)</sup>.

Before the vaccine was available, mumps was a world-wide infection. Immunization began in 1967. In the United States (US), for example, the incidence of mumps in children had dropped sharply from 44.3% in 1977 to 16.6% in 1979, and now, by more than 95%. Though serological studies have shown that around 80 to 90% of the adult population in the US have developed immunity against mumps, recent findings also show that around 30 to 40% of all infected persons are clinically inapparent<sup>(7)</sup>.

Taiwan began mass Measles, Mump, Rubella (MMR) immunization in January 1992. All children under the age of 15 months are required to be vaccinated. In addition, school children in the first or sixth grades of primary school and the third grade of junior high school were also vaccinated. Kindergarten children who

have not had prior MMR immunization are given a make-up. The protective rate is higher than 95%<sup>(3)</sup>.

## 2. Materials and Methods

### Survey tool

Children of the kindergarten under study were provided with a structured questionnaire containing such background information questions as name, sex, birth-date, order among siblings, class in the kindergarten, use of school bus, symptoms if any, self or siblings' feelings of discomfort, date of onset of symptoms, history of mumps, contacts, and immunization record. The questionnaire was distributed on 21 November to be filled out by parents and returned.

### Definition of a case

A case was defined as a child who became ill between 1 September and 21 November 1994, and who developed swelling of the parotid gland(s)<sup>(4)</sup>.

## 3. Findings

A total of 106 copies of the questionnaire were distributed to each of 106 children. Seventy-one copies (67.8%) were returned by 36 boys and 35 girls, at a sex ratio of 1:1. Their ages ranged from three to six years. Thirty-two (45%) were in the senior class, 27 (38%), in the intermediate class and 12 (17%), in the junior class. Of the families represented, 57.7% had two children. Thirty-four children (48%) used the school bus. Fifty-nine children (83.1%) described having felt uncomfortable during the 1 September to 21 November period. Forty-two children (59.2%) had been immunized with MMR; 4 (5.6%) had had mumps previously, 65 (91.6%) had never had, mumps; and 2 (2.83%) did not know. (see Table 1).

Of the 59 children who had developed some symptoms, 18 had swelling of the parotid glands. Of these, some (55.56%) had coughing, fever (27.78%), headache (22.22%), and abdominal pain (22.22%). (see Table 2)

The male/female sex ratio of the 18 who had swelling of the parotid glands was 1:1.25; 13 (72.2%) of them were in the 5-6 year age group. Only 4 children (22.2%) had had immunizations, with immunization records issued by a clinic, the other 12 had not been immunized. Nine children used the school bus, and nine did not. Of the 18 children, 55.6% of their siblings had been immunized, and 88.9% of them said they had never contacted any mumps patients outside the kindergarten. (see Table 3).

## 4. Discussion

The literature shows that mumps is more prevalent in spring (April-May)<sup>(2)</sup>. In

Table 1. Background Information of Children

	No.	%
	N=71	100
Class: senior	32	45.07
intermediate	27	38.03
junior	12	16.90
Sex: male	36	50.70
female	35	49.30
Age: >6 years	9	12.68
5	25	35.21
4	27	38.03
3	9	12.68
<3	1	1.41
Family size: 1 child	20	28.17
2 children	41	57.75
3 children	10	14.08
Use school bus: yes	34	47.89
no	37	52.11
Felt uncomfortable: yes	59	83.10
no	12	16.90
Vaccinated with MMR: yes	42	59.15
no	26	36.62
don't know	3	4.23
Ever being infected with mumps: yes	4	5.63
no	65	91.55
don't know	2	2.82

Table 2. Distribution of Mumps Symptoms, September-November 1994

	Case	%
	N=18	100
Swelling of parotid glands	18	100.00
Fever	5	27.78
Coughing	10	55.56
Headache	4	22.22
Abdominal pain	4	22.22

Table 3. Comparing Mumps Cases and Non-cases

	Case	%	Non-case	%	p-value
	N=18	100	N=53	100	
Class: senior	8	44.44	24	45.28	0.99
intermediate	7	38.89	20	37.74	
junior	3	16.67	9	16.98	
Sex: male	8	44.44	28	52.83	0.73
female	10	55.56	25	47.17	
Age: >6 years	7	38.89	0	0.00	0.48
5	6	33.33	9	16.98	
4	3	16.67	19	35.85	
3	1	5.56	19	35.85	
<3	1	5.56	6	11.32	
Immunization with MMR: no	12	66.67	14	26.42	0.00*
yes	4	22.22	38	71.70	
DK <sup>#</sup>	2	11.11	1	1.89	
Use of school bus: no	9	50.00	28	52.83	0.83
yes	9	50.00	25	47.17	
Siblings immunized: no	5	27.78	15	28.30	0.99
yes	10	55.56	29	54.72	
DK	3	16.67	8	15.09	
Contact with case: no	16	88.89	39	73.58	0.34
yes	0	0.00	3	5.66	
DK	2	11.11	11	20.75	

Cases: children with swelling of the parotid glands after 1 September 1994.

Non-case: children without swelling of the parotid glands after 1 September 1994.

\*  $p < 0.05$ . # DK: Didn't know.

Table 4. MMR Immunization and Mumps

	Infected	Not Infected	Total
Immunized with MMR	4	38	42
Not immunized with MMR	12	14	26
Total	16	52	48

Measles vaccine efficacy

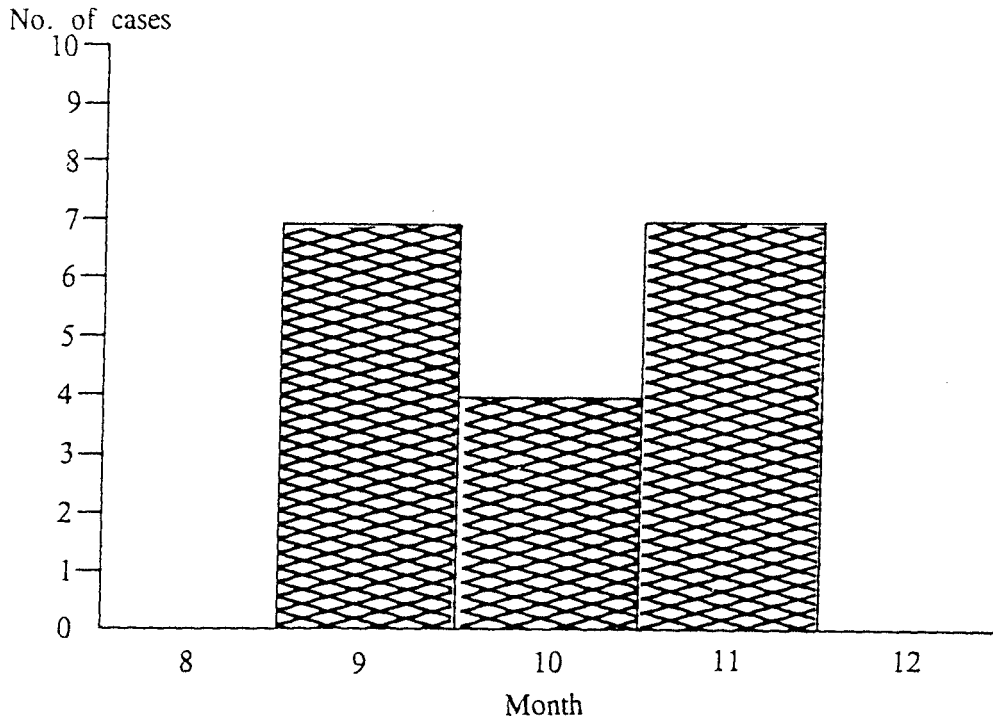
$(ARU - ARV) / (ARU \times 100)$

ARU: attack rate of those not immunized with MMR

ARV: attack rate of those immunized with MMR

$(12/26 - 4/42) / (12/26) = 0.794$

Figure 1. Epidemiological Distribution of Mumps in a Kindergarten in Kaohsiung City, 1994



1993 in the Taiwan Area, for instance, more mumps cases occurred between April and July<sup>(6)</sup>. The present incident occurred, however, in summer and autumn, with the survey reporting some infections in September. August was summer vacation time, with more irregular school attendance. This survey, therefore, traced back only the September cases; no attempt was made to follow any August. Thus, identified cases concentrated on the months between September and November, and the initial index case was not identified. A complete picture of the outbreak, could thus not be obtained even by looking at the records of cases during that period of time. The survey was conducted long after the incident, and recall bias could have played a part in the process of data collection.

Mumps is primarily transmitted by droplet and saliva. The infection rates of children using and not using school buses in the present survey were 26% and 25%, respectively. Children sharing the same bus or classroom with patients were found not necessarily to have a higher infection rate.

If the unreturned questionnaires were not considered, of the 71 returned, 42 indicated previous MMR immunization, giving an immunization rate of 59.2%. Compared with the 67.1% and 79.2% immunization rates for Kaohsiung City in 1993-1994, the immunization rate of children attending this kindergarten was low.

When the 18 children with parotid gland swelling and the 53 without such swelling

were compared, no statistically significant differences were noted in terms of class, sex, age, use of school bus, MMR immunization of siblings, and contact with cases outside the kindergarten. However, a statistically significant difference was noted between the two groups when they were compared in terms of immunization with MMR, showing that immunization is indeed protective.

The literature shows that infection with mumps leads to life-long immunity, and that passive immunity by MMR immunization is more than 95% protective<sup>(3)</sup>. In the present survey, of the 18 children who had symptoms, 4 had been immunized with MMR, yet they also developed symptoms. Thus, in the 42 children who had been immunized, the vaccine failure rate was estimated to be around 9.5%. The effectiveness<sup>(5)</sup> of MMR vaccine for the kindergarten as a whole was estimated to be around 79.4%.

Though only 18 children met the definition of "case", 3 other children were diagnosed mumps by physicians between September and November, though the children did not develop swelling of the parotid glands. A mumps case is diagnosed primarily based upon that swelling. These four children's reported condition could have been the result of parental recall bias or of inattention to the actual symptoms. Community physicians make their diagnoses on the appearance of the symptoms (swelling of the parotid glands) and not on serological findings, their chances of making errors are low. We, therefore, suspect that the total number of mumps cases in this incident should have been 21 (30%).

Whether it is adequate to define cases by swelling of the parotid glands is another issue. Morbidity and Mortality Weekly Report (MMWR), in its 1990 "Case Definitions for Public Health Surveillance"<sup>(4)</sup> gave the clinical definition of a mumps case as "one who has swelling of one or both of either the parotid or salivary glands for more than two consecutive days; and that, when the incident has epidemiological relevance, cases can be so confirmed without serological testings". The present survey was conducted following these definitions. Though no serological testing was made, it would not have affected the identification of cases.

Only 5 and 11 mumps cases were reported in Kaohsiung City in 1993 and 1994, respectively<sup>(6)</sup>. In this kindergarten alone, 18 cases were identified, and of those, only 1 was reported. The reporting rate was seriously low. (95% low)

Of the 18 children, 4 had been immunized with MMR. The effectiveness of MMR vaccine for the kindergarten as a whole was estimated to be around 79.4%. Many studies have shown the effectiveness of MMR vaccine to be 90-95%, the 79.4% effectiveness found in the present survey is significantly low. The 67% return rate of questionnaires in the present survey could have led to the low estimate of the effectiveness. However, even if the 35 children who failed to return the questionnaires were considered as having been immunized, and thus not to have developed mumps, the effectiveness of MMR was still as low as 89%. The vaccine effectiveness of MMR in Taiwan should be re-evaluated.

## 5. Recommendations and Limitations

A. Mumps is, clinically and in community medicine, considered to be a mild disease which is sometimes clinically overlooked. However because of the risk of developing such complications as orchitis (20-35%) and oophoritis (3-17%), the disease should not be left unnoticed. Case reporting of the disease should be reviewed and improved.

B. The effectiveness of MMR vaccine was found to be low, according to the present survey's results. Disease control authorities are requested to reevaluate the effectiveness of MMR vaccines in current use in Taiwan.

C. Records of the immunization of children were hard to find. When an attempt was made to check the information on the questionnaires against the records of the local health station in order to review immunization status, it was found that no such records existed there. It is recommended that immunization records be appropriately managed.

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