



Mumps Outbreak among School-Aged Children in X Sub-District 2024

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Abstract

Background: On November 14, 2024, X Health Office received a report of seven mumps cases from the EWARS (Early Warning, Alert and Response System). An epidemiological investigation was conducted to confirm the cases, identify risk factors, and make recommendations to control the outbreak.

Methods: A case-control design was used, based on interviews using questionnaires. A case was defined as an individual with parotid gland swelling and other symptoms between September and December 2024, as determined through clinical assessment. Controls had contact with cases but no symptoms were observed. Data were analyzed using chi-square tests.

Results: There were 97 cases across five schools, with the highest attack rate observed at School C (13.3%). The highest attack rate was in Class 3C at School A (63.33%). The Index case involved a student from class 3A at School A, who then spread it to other classes and schools. Most cases were found among males (51.5%) and aged 5-12 years (99%). The main symptoms were parotid gland swelling (100%), fever (93.8%), and sore throats (54.6%). The cases had completed basic immunization (93.8%), never received MMR vaccine (93.8%), history of contact (97.9%), washing hands with soap (54.6%), not wearing masks (88.7%), and not sharing cutlery (70.1%). The peak number of cases occurred between November 10 and 16, 2024. MMR vaccine history is a protective factor (OR=0.30 (0.11-0.82); $p<0.001$), and sharing cutlery is a risk factor (OR=6.11 (2.38-15.70); $p<0.001$).

Conclusion: Control measures must prioritize school hygiene policies, case isolation, and MMR vaccination to prevent future outbreaks.

Keywords: Mumps, Outbreak, School-Age, Children, Risk Factor

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Introduction

Mumps is a contagious viral infection caused by the mumps virus, which belongs to the Paramyxoviridae family.¹ Mumps virus infection typically affects the salivary glands, including the parotid, submandibular, sublingual, and other associated glands. Mumps can cause parotitis, which is the swelling of the parotid

glands located in the salivary gland area.² This disease is vaccine-preventable. Mumps is transmitted through droplets and saliva contaminated with the mumps virus, which an infected person releases when coughing, sneezing, or talking.³ Transmission can also occur by touching objects or surfaces contaminated by an infected person and then touching the nose or mouth without first washing hands,

allowing the mumps virus to spread.⁴ Mumps remains a vital childhood disease in many parts of the world, primarily affecting children between the ages of 5 and 9.⁵ Adults can also become infected, but the prognosis is often more severe.^{2,5}

Clinical manifestations include fatigue, neck muscle pain, headache, and fever, followed by painful, tender swelling of the parotid glands.^{6,7} Complications can arise if the virus spreads to other tissues, causing encephalitis, meningitis, orchitis in males, nephritis, and potentially leading to hearing loss or deafness.^{6,7} According to the CDC, the incubation period for mumps is 12 to 25 days, with an average of 16 to 18 days.⁸

Based on the Regulation of the Minister of Health of the Republic of Indonesia Number 1501 concerning Types of Certain Infectious Diseases That Can Cause Outbreaks and Control Efforts, a condition is declared an outbreak (KLB) if it meets one of the specified criteria.⁹ The criteria are the occurrence of an infectious disease in the community with a continuously increasing incidence rate over three consecutive periods of hours, days, or weeks, depending on the type of disease.⁹ The Directorate General of Disease Prevention and Control of the Ministry of Health has issued Circular Letter Number PM. 03.01/C/2737/2024 regarding Awareness of the Increase in Mumps Disease.¹⁰

On November 4, 2024, the surveillance officer of Puskesmas X received information that one of the children of the Puskesmas cooperative officer had mumps. The cooperative officer also mentioned that many children at his son's school (School B) had mumps. On November 14, 2024, Puskesmas X reported to the X Regency Health Office that 7 cases of Mumps had been entered into the EWARS and that an outbreak (KLB) had been declared.

In response to the suspected outbreak, the X Community Health Center, along with Kader, village midwives, and Undip students, conducted an epidemiological investigation to verify the outbreak, assess the risk factors, analyze case distribution, and identify any additional cases. Epidemiological

investigations were conducted on November 16th, 18th, 19th, and 26th, 2024. The findings confirmed the transmission of mumps cases across several schools, including School A, School B, School C, School D, and School E.

Mumps cases have occurred since September 2024, with 97 instances spread across five schools. There was a delay in reporting and investigating mumps cases, which allowed the transmission to continue for up to three months. The investigation revealed that many children with mumps continued to attend school, resulting in in-class transmission. Additionally, parents and teachers, including homeroom teachers, were unaware that mumps is a communicable disease. Consequently, as part of the investigation, health education sessions were conducted for students, parents, and school personnel to enhance awareness of mumps, including its mode of transmission, preventive measures, and control strategies. These interventions aim to prevent the further spread of cases in the affected schools. Based on the above facts, this study aimed to describe the outbreak and analyze its associated risk factors.

Methods

This was an analytical observational study with a case-control design. The study population consists of school-aged children who have been diagnosed with mumps in District X. A case was defined as an individual who experienced the primary clinical symptom of parotid or submandibular gland swelling, accompanied by other symptoms such as fever, sore throat, jaw pain, or loss of appetite, from September to December 2024, and established diagnosis through clinical examination by observing swelling of the parotid glands in affected individuals. Controls were defined as individuals who had close contact with a case between September and December 2024 but did not exhibit clinical symptoms of parotid or submandibular gland swelling. A total of 97 students were selected as controls and matched to the cases by sex and age. Data were collected through structured

interviews. The data were analyzed using descriptive and analytical methods, with statistical significance tested using the chi-square test.

Results

As shown in Table 1, the most common clinical symptoms of mumps were parotid gland enlargement (97, 100%) and fever (91, 93.8%). These two symptoms are clinical signs used to confirm the diagnosis of mumps infection. In this study, no patient experienced complications.

As shown in Table 2, mumps occurred more frequently in males (50 cases; 51.5%) than in females (47 cases; 48.5%). The majority of cases were in the children's age group (5–12 years),

accounting for 96 individuals (99%). The control group had characteristics comparable to those of the cases, with 50 males (51.5%) and children aged 5–12 years (99%).

Based on Table 3, most mumps cases occurred at School A, with 54 cases (55.67%), followed by School B, with 35 cases (36.08%). The highest attack rate was recorded at School C (13.33%), followed by School A (10.56%) and School B (9.21%).

As shown in Table 4, the highest attack rate (AR) was observed in Class 3C at School A (66.7 %), followed by Class 1A at School B (57.9 %). At School D, the highest attack rate was recorded in grade 3 at 18.2%.

Table 1. Symptoms of Mumps Outbreak

Symptoms	f	%
Swelling Gland Parotid	97	100
Fever	91	93.8
Sore Throat	53	54.6
Tiredness	51	52.5
Loss of appetite	44	45.3
Back Jaw Pain	43	44.3
Headache	34	35.0
Rash	7	7.2

Table 2. Characteristics of Case and Control

Variables	Case		Control	
	f	%	F	%
Gender				
Male	50	51.5	50	51.5
Female	47	48.5	47	48.5
Age Group				
Toddler (0 - < 5 years)	1	1.0	1	1.0
Children (5-<12 years)	96	99.0	96	99.0

Table 3. Case Distribution by School

School	f	%	Population	Attack Rate
School A	54	55.67	511	10.56
School B	35	36.08	380	9.21
School C	4	4.12	30	13.33
School D	3	3.09	57	5.26
School E	1	1.03	130	0.76

Based on the epidemiological curve above, the first case was identified on September 5, 2024, at School A. Considering the incubation period of approximately 18 days, the initial exposure is estimated to have occurred in August, specifically between August 18 and 31, 2024. The peak of mumps cases occurred from November 10 to 23, 2024, with 28

cases reported. Following November 23, 2024, the number of cases declined significantly.

Based on Table 5, the variables not significantly associated with the incidence of mumps were complete basic immunization ($p = 0.434$), history of travel ($p = 0.172$), handwashing with soap ($p = 0.315$), and mask usage ($p = 0.310$). In

contrast, a history of MMR vaccination ($p = 0.010$) and sharing eating and drinking utensils ($p = 0.000$) were significantly associated with the incidence of mumps in the school clusters of District X. The MMR vaccination variable had an odds ratio (OR) of 0.271 with a 95% confidence interval (CI) of 0.103–0.711, indicating that a history of

MMR vaccination served as a protective factor against the occurrence of mumps. In contrast, sharing eating or drinking utensils had an OR of 6.648 (95% CI, 2.543–16.451), suggesting that sharing utensils is a significant risk factor for mumps transmission.

Table 4. Case Distribution by Class

School		f	%	Population	AR (%)
School A	Grade 1B	7	7.2	32	21.9
	Grade 1C	15	15.5	32	46.9
	Grade 2B	2	2.1	30	6.7
	Grade 2C	1	1.0	30	3.3
	Grade 3A	4	4.1	30	13.3
	Grade 3B	5	5.2	28	17.9
	Grade 3C	20	20.6	30	66.7*
School B	Grade 1A	11	11.3	19	57.9*
	Grade 1C	1	1.0	27	3.7
	Grade 2B	6	6.2	22	27.3
	Grade 2C	2	2.1	22	9.1
	Grade 3C	3	3.1	22	13.6
	Grade 4B	2	2.1	22	9.1
	Grade 5A	1	1.0	22	4.5
School C	Grade 5B	9	9.3	26	34.6
	Grade 1	4	4.1	15	26.7
School D	Grade 1	1	1.0	11	9.1
	Grade 3	2	2.1	11	18.2
School E	Grade 2C	1	1.0	24	4.2

Table 5. Bivariate Analysis

No	Variables	Case	Control	p-value	OR	95 % CI	
		n= 97	n= 97			Lower	Upper
1.	Basic Immunization						
	Complete	91 (93.8%)	87 (89.7%)	0.434	1.74	0.608	5.001
	Not Complete	6 (6.2%)	10 (10.3%)				
2.	MMR Vaccine						
	Yes	6 (6.2%)	19 (19.6%)	0.010*	0.27	0.103	0.711
	No	91 (93.8%)	78 (80.4%)				
3.	History of Travel						
	Yes	7 (7.2%)	2 (2.1%)	0.172	3.69	0.748	18.257
	No	90 (92.8%)	95 (97.9%)				
4.	Washing Hands						
	Yes	53 (54.6%)	45 (46.4%)	0.315	1.39	0.791	2.449
	No	44 (45.4%)	52 (53.6%)				
5.	Mask Usage						
	Yes	11 (11.3%)	6 (6.2%)	0.310	1.94	0.687	5.475
	No	86 (88.7%)	91 (93.8%)				
6.	Sharing Utensils						
	Yes	29 (29.9%)	6 (6.2%)	0.000*	6.64	2.543	16.451
	No	68 (70.1%)	91 (93.8%)				

Discussion

Mumps is a viral infection caused by the mumps virus that affects the salivary glands, including the parotid, submandibular, and sublingual glands, leading to swelling in these areas.¹

Transmission occurs through droplets and saliva contaminated with the mumps virus, which is transmitted when an infected person coughs, sneezes, or speaks.² Most mumps cases affect school-aged children, especially those in the 5–9 year age group.⁷ As a result, schools serve as one of

the primary settings for the transmission of infectious diseases among school-aged children, such as dengue fever, hand, foot, and mouth disease, measles, rubella, chickenpox, mumps, and eye infections.¹¹

The school-based mumps cluster in District X predominantly affected male students (51.5%). Male students tend to engage more frequently in group physical activities than female students, such as playing with peers, participating in sports, and sharing food and drinks, which may contribute to increased transmission.¹² These behaviors increase the likelihood of male students being exposed to the mumps virus, particularly in school and other activity settings. In this outbreak, most cases occurred among children aged 5–12 years, with a total of 96 individuals affected. Mumps frequently affects children above the age of two, and transmission among children can occur easily through contact with contaminated objects, such as toys handled by an infected child.¹³

School A reported the highest number of cases (54 cases, 55.67%). This school was the site of the index case, which occurred on September 5, 2024, in Class 3A. School A is a well-regarded private Islamic school in District X, accredited with a 'B' rating, and established in 1990.¹⁴ This school offers a wide range of extracurricular activities that support students' talents and interests. In addition, as an Islamic school, it hosts more religious activities than regular schools. The high number of extracurricular and religious events results in frequent gatherings and group activities among students, which may increase their exposure to the mumps virus.

During this mumps outbreak, a higher incidence was observed among lower-grade students (grades 1–3) than among upper-grade students (grades 4–6). According to a 2024 study by Elma Mahfuzhoh, these two grade groups differ in their activity patterns: students in grades 1 to 3 tend to engage in indoor activities, whereas those in grades 4 to 6 are more likely to participate in outdoor activities.¹⁵ Mumps are transmitted through airborne droplets, making indoor activities with an infected individual pose a higher risk of transmission. In addition, according to the

statements from class teachers, students in Grades 1 to 3 were more likely to share food and eating and drinking utensils with their peers than students in Grades 4 to 6.

To ensure that mumps transmission had ceased, a forward monitoring period of two incubation cycles (36 days) was conducted from the date of the last reported case. The duration of the mumps outbreak was determined to be September 5, 2024, to January 6, 2025, spanning 72 days. Mumps cases occurred as early as September 2024 but were not reported until November 2024, resulting in delayed reporting and control measures. This delay prolonged the transmission period, extending the outbreak to approximately three months.

Immunization is a specific form of disease prevention applicable across all age groups, from children to adults and the elderly, through the administration of vaccines.¹⁶ Through immunization, individuals are expected to develop immunity by generating and increasing antibody levels within the body.¹⁶

The results of this study indicate that a history of basic immunization was not significantly associated with the incidence of mumps in Subdistrict X. In this study, a history of complete basic immunization (CBI) was not significantly associated with the occurrence of mumps outbreaks. This may be attributed to the fact that most respondents had already received complete basic immunization. According to data from the District Health Office of X, basic immunization coverage in Subdistrict X exceeded 90% in 2023.¹⁷ This indicates that over 90% of children in Subdistrict X are protected against vaccine-preventable diseases. Furthermore, immunization coverage data from areas outside Subdistrict X also show a rate exceeding 90% in 2023.¹⁷

Mumps is a vaccine-preventable disease. The measles, mumps, and rubella (MMR) vaccine is an additional vaccine administered to children to prevent mumps infection. The analysis in this study showed that a history of receiving the MMR vaccine was significantly associated with the occurrence of the mumps outbreak in the school cluster in Subdistrict X. The odds ratio and 95% confidence interval indicated

that a history of MMR vaccination was a protective factor against mumps. Therefore, individuals who have received the MMR vaccine are less likely to develop mumps.

In Indonesia, the MMR vaccine is not part of the routine immunization schedule or included in the mandatory program by the Ministry of Health. Consequently, MMR vaccines are not provided free of charge by community health centers (puskesmas), and not all children receive MMR vaccination. The MMR vaccine is administered in two doses: the first dose is given at 12–15 months of age, and the second dose is given at 4–6 years of age.¹⁸ The first dose provides approximately 72% adequate protection against mumps, while the second dose increases protection to about 86%.¹⁸

The CDC states that traveling to other cities or areas experiencing a mumps outbreak increases the risk of contracting the disease.¹⁹ However, in this study, travel history was not significantly associated with the incidence of mumps in Subdistrict X. Most children had not traveled outside the city within one month before the onset of the illness. This may be because Subdistrict X is located in a highland area, relatively far from the city center.²⁰ The mumps virus can be transmitted through contact with contaminated objects, making handwashing with soap an important factor in preventing the spread of mumps.^{4,21} Individuals who practice proper handwashing with soap are at a lower risk of contracting mumps. However, in this study, the habit of handwashing with soap was not significantly associated with mumps incidence. This may be due to the lack of differences in the proportion of handwashing between the case and control groups. According to the homeroom teachers, students are consistently reminded to wash their hands before meals during the school hours.

The mumps virus can be transmitted through airborne droplets released when an infected person coughs, sneezes, or talks.^{4,22} Therefore, wearing a mask is considered preventive behavior to reduce the risk of mumps transmission. In this study, mask use was not associated with mumps cases in the school cluster

outbreak in Subdistrict X, and most schoolchildren did not wear masks when they were ill or during activities where mask-wearing was advised. In both the case and control groups, most children did not use masks in their daily activities, either at school or home. A study found that the compliance rate among elementary school children wearing masks remains low, at only 51.6%.²³ This is because children complain of heat, difficulty breathing, and discomfort when wearing masks.²³

Bivariate analysis in this study showed that sharing eating utensils was significantly associated with mumps infection. Mumps is transmitted through direct contact with saliva or droplets from an infected individual's mouth, nose, or throat, and can contaminate objects, particularly eating and drinking utensils.^{4,19} Therefore, the behavior of sharing eating or drinking utensils is a factor that can increase the risk of mumps virus transmission.¹⁰ In this study, students who shared eating or drinking cutlery were found to be six times more likely to contract mumps compared to those who did not share such cutlery. Elementary school children often share drinking bottles or packed meals with their classmates, a practice that can be a route for mumps transmission through shared eating and drinking utensils. This is consistent with the findings of a mumps outbreak investigation in Bangkok, which indicated that sharing cutlery for eating and drinking is a significant source of mumps transmission.²⁴

Conclusion

An outbreak of mumps occurred in five schools in District X, characterized by the emergence of initial cases in previously unaffected areas and a continuous increase in incidence over a three-period, from September to November 2024. The most commonly reported clinical symptoms were salivary gland swelling and fever. The affected individuals were predominantly male and aged 5–12 years. The highest number of cases was reported in School B, whereas Class 3C of School A had the highest attack rate (AR). A history of MMR vaccination was identified as a protective factor, whereas sharing eating utensils was

identified as a risk factor for mumps infections. Key control measures include strengthening hygiene practices in schools, ensuring timely isolation of cases, and increasing vaccination coverage.

Ethics approval

This study was approved by the Faculty of Public Health, Diponegoro University (407/UN7.F9.1/AK/XI/2024)

Availability of data and materials

The dataset generated and/or analyzed in this study is not publicly available to protect the respondents' privacy and confidentiality.

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Author Contribution

NA was responsible for the study design, data collection, statistical analysis, and interpretation of the results. YD, FM, and IA guided the study. All authors contributed to the critical revision of the manuscript and approved its final version.

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