



Outbreak, Surveillance and Investigation Reports

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Investigation on Measles Outbreak among University Students in Phrae Province, Thailand: Risk Factors and Seroprevalence of Antibodies to Measles

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Abstract

Medical record review, active case finding and environmental survey were conducted to investigate a suspected measles outbreak notified in Phrae Campus, Maejo University, Rong Kwang District, Phrae Province, Thailand. Specimens were collected for testing Measles IgM, IgG at National Institute of Health, and case-control study was applied among the first year students to identify agent and risk factors of the outbreak. 13.9% (6/43) of symptomatic students were positive to measles IgM. 8.1% (3/37) of asymptomatic students were negative to measles IgG. No virus was isolated from urine and throat swab specimens. Taking care of measles cases (OR=10.9, 95%CI=2.4-50.2) and studying in department of food technology (OR=6.2, 95% CI=1.9-20.6) were identified risk factors. Health education for students about transmission mode of measles and its prevention measures, provision of masks for students having fever during outbreak, strict isolation and vaccination for 77% of all students had been implemented.

Keywords: Measles outbreak, Maejo University

Introduction

Measles is an acute, highly communicable viral disease with prodromal fever, conjunctivitis, coryza, cough and small spots with white or bluish white centers on an erythema based on buccal mucosa (Koplik's spots). Its incubation periods normally are 7-14 days.¹ Modes of transmission of measles are by droplet spread and direct contact with nasal or throat secretions of infected persons. Measles vaccination is one of the very effective measures to prevent measles.^{2,3} Some researchers found that the efficacy of measles vaccine is 92-98%.^{4,5} In Thailand, the first dose of measles vaccination was incorporated into the national immunization program for children aged nine months in 1984, the second dose of measles vaccine was added in 1996 for first grade students aged seven years. The coverage of measles vaccine increased from 49% to over 96% in 2003.⁶ In a nationwide cross-sectional survey in Thailand in 2008, Measles, Mumps and Rubella (MMR) vaccine coverage among the first grade students in 360 was reported to be 91.2%.⁷ However, Thailand has

still reported some measles outbreaks in children, high school students and young adults (Figure 1).^{8,9,10} In a hospital-based report on a measles outbreak in children in Suphan Buri Province in 1998, it was concluded that 50% of the cases had not been previously given measles vaccine. Of these, 9-15 years age group (28.9 out of 50%) was the most vulnerable.⁸

Phrae Province is in the north of Thailand, with population of 467,653, covers 6,538.59 km². From 2004 to 2007, the number of measles cases ranged from 11 to 30 cases; the highest number of measles cases was recorded in 2006 at 30 (morbidity rate was 6.4 per 100,000). In the first five months of 2008, there was only one measles case reported in March.

In Rong Kwang District, the number of measles cases recorded was few in recent years from 2004 to 2007, and there were one to two cases per year. In the same period in 2008, no measles case was recorded [Annual report of Measles incidence of Rong Kwang District Health Office, Phrae Province, Thailand, unpublished].

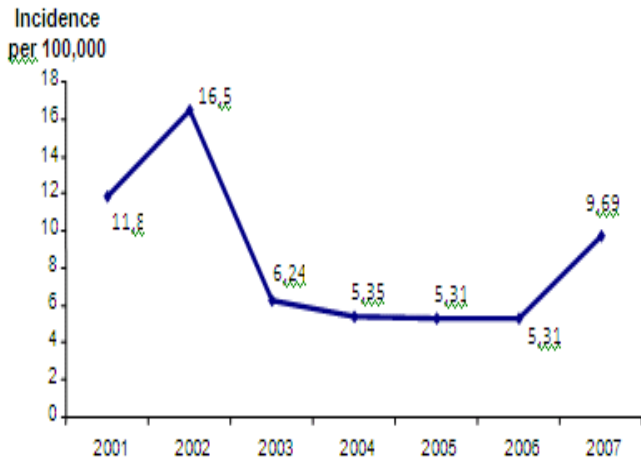


Figure 1. Measles incidence in Thailand from 2001-2007

Mae Jo University is an agricultural university with its main campus located in Chiang Mai Province, having a total number of 8,809 students. The Phrae campus is a branch of Mae Jo University in Rong Kwang District in Phrae Province, with a total student in year 2008 at 1,832. In 2008, all first year students in the Phrae campus participated in orientation in Chiang Mai from 28 May to 8 Jun. During the first week of June 2008, there were reports of some suspected cases of measles in Chiang Mai, before prevention and control measures had been implemented.

On 26 Jun 2008, Bureau of Epidemiology received report from the local public health office in Phrae Province that students reported having fever and rash while some, suspected of manifesting measles symptoms, admitted to the community hospital in Rong Kwang District. Meanwhile, many other students in the Phrae campus developed similar symptoms. Most of them were first year students from different provinces in Thailand, and they had recently returned from the orientation in Chiang Mai Province. As this was an unusual health event in a university campus, Bureau of Epidemiology sent an investigation team to Phrae Province to carry out an outbreak investigation. Participants of team included staff and trainees of Field Epidemiology Training Program (FETP), representatives of Communicable Disease Control and Prevention Office Region 10, the Provincial Health Office in Phrae Province and the Rong Kwang District Health Office. The investigation was conducted from 28 Jun to 2 Jul 2008, and supported for active surveillance which continued until 28 Jul 2008.

The objectives of the study were to investigate and evaluate magnitude of the outbreak, identify risk factors of the outbreak, and recommend preventive and control measures.

Methods

Records of patients visiting the community hospital in Rong Kwang District from 26 May 2008, two days prior to the orientation in Chiang Mai, to 29 Jun 2008, were reviewed to identify suspected cases. There were seven patients suspected of having measles, all of them were students in the Phrae campus. The first case was admitted to the hospital on 16 Jun 2008.

Active case finding was conducted by the investigation team in the Phrae campus from 29 Jun to 3 Jul 2008 through a survey which included interviews and physical examination. Campus announcement was broadcasted to call all students and campus staff to a common building. Students and some staff members in the Phrae campus were asked about whether they had history of fever from 15 May 2008 (date of arrival at the campus by first year students) to 30 Jun 2008 (date of investigation). Students with history of fever during this time were interviewed and physically examined to find out other symptoms related to measles case definition and its complications, bringing the total number of students screened to 1,589 (with a total of 1,832, the screening coverage reached 86.7%).

A suspected case was a student who had fever with rash and any of these symptoms: cough, conjunctivitis, coryza, Koplik's spots from 15 May to 28 Jul 2008. A confirmed case was a suspected case having confirmation by IgM positive or viral isolation from laboratory.

The Provincial Health Office in Phrae Province and the health office in Rong Kwang District additionally carried on a surveillance for all 1,832 students in the university to identify new measles cases for 20 days after the last case identified in the outbreak (28 Jul 2008).

Follow-up measures included creating guidelines on measles such as case definition, preventive and control measures; follow-up on students in the university; reporting all cases that met the case definition, zero report for no case; conducting active surveillance by collecting data from hospital, community, survey; and distributing Information, Education and Communication (IEC) to people about modes of transmission, prevention and control of measles.

A group with five persons in the investigation team was assigned to observe living and studying conditions of students in the campus, dormitories, classrooms, cafeterias and a sporting field. Dormitory rooms of both healthy and sick students were also

observed. Some students were interviewed about their daily life in the campus.

Single serum specimens were collected from students who had fever or rash to be tested for detecting measles IgM antibody by ELISA technique using Enzygnost Anti-Masern-Virus/IgM (Dade Behring, Germany)¹¹. Those with both fever and rash had their throat swabs and urine collected for viral isolation using Vero/hSLAM cell. Some students who had no symptoms of measles by case definition had their blood specimens collected and tested for measles IgG to check measles immunity. All the specimens were tested at WHO Measles Regional Reference Laboratory in SEAR, National Institute of Health under Department of Medical Sciences, Ministry of Public Health of Thailand.

The case-control study was conducted among the first year students in the university. The first year students who met case definition were defined as cases while controls were the first year students who had no symptoms, were without laboratory result tested positive for IgM or IgG and were with no history of getting measles. The case and control ratio was 1: 4.

Therefore, from 537 first year students interviewed, 279 students had neither symptoms nor positive laboratory results, and without history of getting measles. We randomly selected 128 students to be control of the analytic study (case = 32).

The reasons to choose the first year students were because of the highest attack rate among them (5.5%), primary cases among them and convenience in control selection.

However, there were limitations as association of risk factors related to students in the other groups could not be analyzed.

By active case finding, reported measles cases in the first year students was 32 (5.5%), and it was the highest incidence among students in any other years. The 32 cases and the 128 controls among the first year students were interviewed to identify risk factors for getting measles among the first year students in the university.

In data analysis, descriptive statistics, chi-square, odds ratio and 95% confidence interval were employed. Risk factors showing statistical differences were further tested for association with measles by employing multiple logistic regression analysis.

Of the total 1,832 students in the Phrae campus, Mae Jo University, 1,589 (86.7%) were interviewed in a survey in order to detect suspected measles cases. The first case was identified at Mae Jo on 4 Jun 2008, one week after their orientation in Chiang Mai campus, while the last case was identified on 10 Jul 2008. Most of the cases occurred in a period 16-30 Jun 2008. The number of cases dropped sharply after 30 Jun 2008 (Figure 2). In the mean time, measles vaccine mop-up was provided.

Results

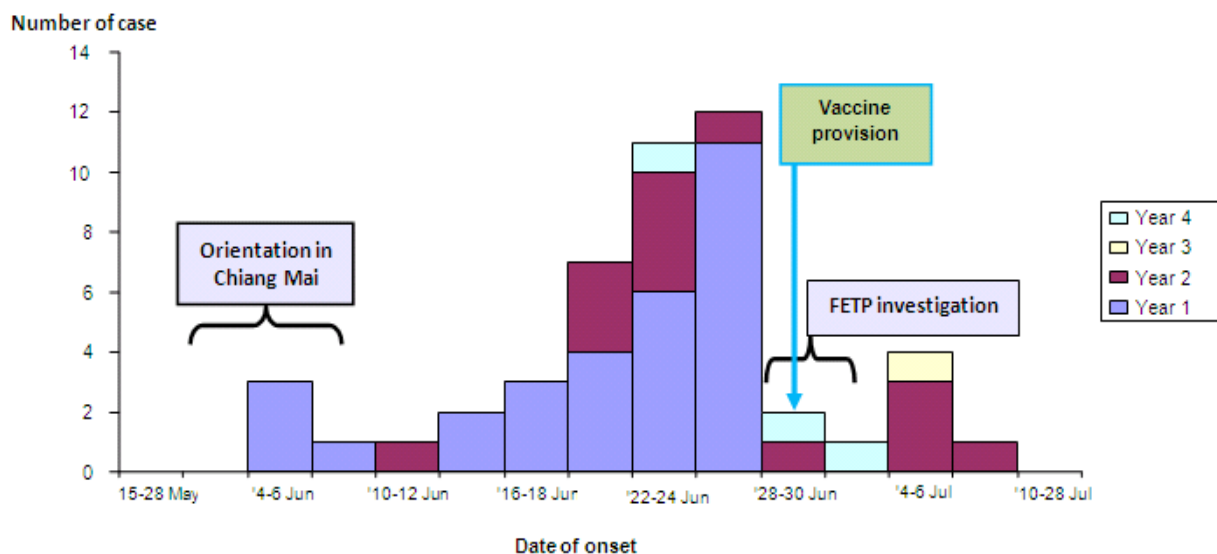


Figure 2. Measles cases by date of onset in Phrae campus, Mae Jo University, 2008 (Three cases have no information on date of onset)

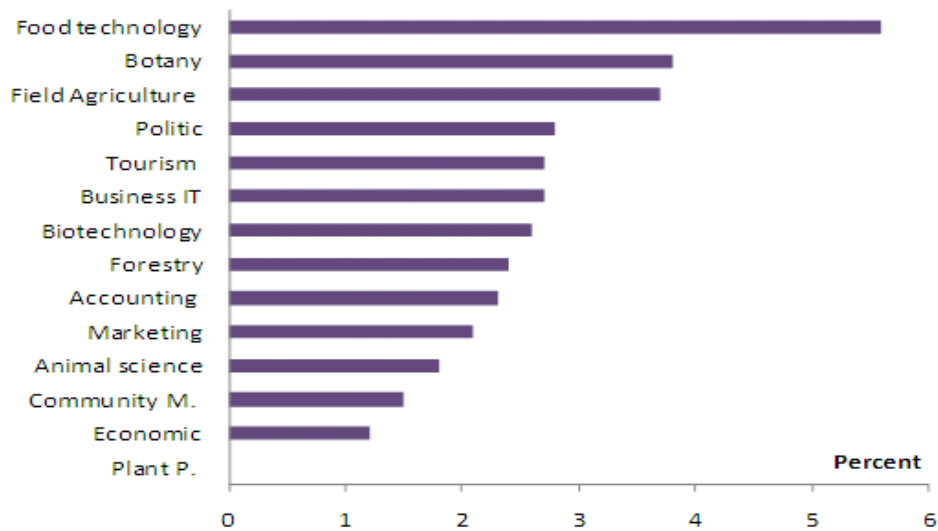


Figure 3. Attack rate of measles among students by departments, Phrae campus, Mae Jo University

A total of 51 symptomatic cases were found, with the attack rate of 3.2%. Among the 51 cases, there were seven reported cases, 35 cases from active case finding and nine cases from surveillance by local health officials. There were other six cases identified in Rong Kwang District, but they were not related to students in the university.

The attack rate was the highest in the first year students (5.5%), followed by the second year students (2.4%), the fourth year students (1.0%) and the third year students (0.3%). The difference was significant (p value <0.05).

The attack rate was the highest in the Food Technology Department (5.6%), while the rates detected in other departments ranged from 0 to 5.6%. Departments of Plant Production had no measles cases.

The youngest student infected with measles was 18 years old, and the oldest at 24 years old. The median of age was 19. The attack rates in male and female students were 2.5% and 3.0% respectively. However, the difference was not significant with 95% confidence interval of 0.5-1.5.

Clinical Manifestations

The most common symptoms of the measles cases were fever and rash (100%), cough (96.1%), coryza (72.0%), conjunctivitis (42.6%) and Koplik's spots (15.2%). In 19.6% of measles cases, diarrhea was a common complication while other kinds of complications were not recorded. Among the measles cases, 71.4% of them had received treatment from out-patient department, yet only 28.6% of them required hospital admission.

From interviews with the first year students about potential factors of getting measles, the results

showed that during the outbreak, many students were exposed to the potential risk; as most of them participating in the orientation in Chiang Mai from 8-28 May (98.1%). The other risk factors included having close contact with patients having fever and rash: talking (35.8%), having roommates with fever and rash (15.1%), taking care of measles patients (15.1%), sharing meals with persons having fever and rash (13.7%), staying or sleeping in same bed with a friend having fever and rash (13.0%), and sharing common utensils (6.3%).

We also reviewed history of students getting measles vaccine. However, there were 23.9% of students who could not recall any history of their measles vaccination. Among those who could, their recollection was flimsy.

Environmental Observation in the University



Figure 4. Students in the class and in the laboratory

There were two dormitories for students: one was for male students, and the other for females. A student bedroom was around 20 m² in space with three to four students roomed together. Each had own wardrobe and personal belongings. Some students with typical symptoms of measles stayed in separate rooms in the dormitories.

In general, dormitories and rooms of students in the university were clean and ventilated. However, the

classrooms were quite crowded, air conditioned and equipped with electric fans, and students shared glasses for drinking water from water filters.

Laboratory Results

There were six specimens (13.9%) tested positive with measles, and seven specimens (16.3%) were equivocal. Among specimens collected from students who met the case definition, there were 28.5% of specimens tested positive with measles. However, we also realized that there were two specimens (6.9%) collected from students who did not meet case definitions positive with measles IgM. Among specimens collected from students having no measles symptoms, there were 81.1% of them tested positive with measles IgG, another 10.8% of them equivocal and another 8.1% negative with measles IgG (Figure 5). In all throat swabs and urine specimens, measles virus could not be isolated.

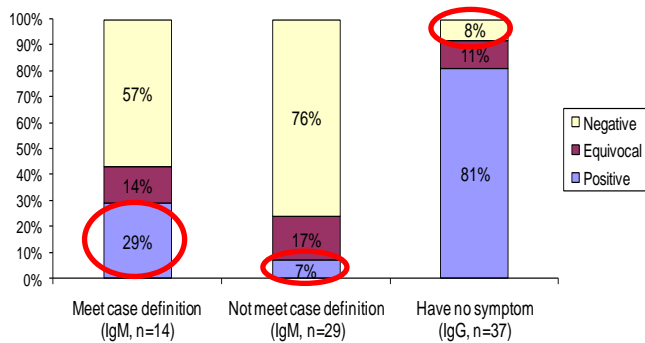


Figure 5. Laboratory results of 80 students

Association of Potential Exposure with Measles during Outbreak

Results of crude analysis showed that there were three exposures significantly associated with getting measles. Students who took care of measles-infected students with fever and rash were 6.4 times more likely to get measles compared to the others (CI 2.5, 16.4). Students who had ever stayed or slept in the same beds with students who had fever and rash were 3.5 times more likely to get measles compared to the others (CI 1.3, 9.4), and students who studied in Department of Food Technology were five times more likely to get measles compared to the others (CI 1.7, 14.6). The other exposures were not significantly associated with getting measles.

Multiple Logistic Regression

To test the association between risk factors and getting measles and the relation among risk factors, multiple logistic regression was employed for only three significant risk factors and one barely significant risk factor; the results are shown below (Table 1).

Table 1. Risk factors of measles in the outbreak

Risk Factor	P value	Adjusted OR	95% CI
Sharing rooms with student having fever and rash	0.610	0.5	0.04, 6.65
Taking care of student having fever and rash	0.002	10.9	2.35, 50.21
Staying/sleeping in the same bed with student having fever and rash	0.803	0.7	0.04, 12.01
Studying in Food Tech Department	0.003	6.2	1.87, 20.62

Consequently, there were two factors significantly associated with getting measles in the outbreak.

Students who took care of measles-infected students with fever and rash were 10.9 times more likely to get measles compared to the others.

Students who studied in Department of Food Technology were 6.2 times more likely to get measles relative to the others.

Discussion

The outbreak was reported rather late to be timely contained, therefore it extended through almost the five-week period. The outbreak affected mostly first year students in the Phrae campus with attack rate of 5.5%; which was much higher than those of the students in the other years. The first case had symptom onset on 4 Jun 2008, one week after participating the orientation in Chiang Mai. In early June 2008, Chiang Mai also recorded an outbreak of measles, which was controlled by the local health authorities. Measles could, therefore, be transmitted from Chiang Mai to Phrae campus.

In this outbreak, one-fourth of measles cases were admitted to hospitals. Moreover, one-fifth had diarrhea complication, which was higher than reported by US CDC as around six percent.¹²

The disease was spread to other students by close contact with an infected person in the university. Taking care of measles patients increased the risk of getting measles, making them about 11 times more likely to get measles compared to others. Studying in the Department of Food Technology significantly increased the risk of getting measles up to about six times more likely to get measles than others. However, no further elaboration could be made because of lack of information about activities of students. The Department of Food Technology which had the largest number of students, its crowded

condition could be a risk factor of measles transmission among students. Nevertheless, association between number of students and attack rate could not be established.

Regarding immunization against measles and history of getting measles, many students however could not recall history of one's own vaccination or ever having measles. Recall bias might be unavoidable in this context. Limitation of immunization against measles was underlined particularly in the early stage of its program launched in 1984. Whereas its coverage was quite low (48%), resulting in outbreaks periodically reported.^{8,9,13} Older generation will still be at risk as in the Suphan Buri cases of 9-15 years age group⁸. In addition, interpretation of data was relatively limited as more details on seroprevalence of antibodies to measles were required.

Based on the laboratory results, proportion of positive IgG among students with no symptom was comparable with the seroprevalence of antibodies to measles among 15-19 years Thai population in 2004.¹⁴ With assumption that the sample could be representative for all students in the university, we estimated that mopping up measles vaccine in the university could be effective for 8% of the students. The environment in the university was clean and the classrooms were air conditioned and/or mechanically ventilated with electric fans. However, natural ventilation could still be possible contributing factors in dormitories and other set-ups. However, measles-infected students staying in the university could continue spreading measles to other students. The specimens for viral isolation were not isolated; it needed enhancing techniques in specimen collection especially for viral isolation.

Conclusion

The measles outbreak in Mae Jo University's Rong Kwang campus in Phrae Province was confirmed by laboratory with attack rate at 3.2%. Taking care of students having fever and rash, studying in Department of Food Technology were risk factors that could increase risk of getting measles. Eight percent of student without symptoms had no immunity of measles.

Prevention and Control Measures

Protective masks for all students and university staff who had fever in that time period and IEC about measles, mode of transmission and its preventive measures were distributed to all students and university staff in the Phrae campus of Mae Jo

University. Vaccination was also provided for all students having no fever during the outbreak.

Recommendations

Local health offices should inform the outbreak in an early stage for timely response. Students should wear protective masks when taking care of the measles-infected patients. Measles patients should be isolated from others. Further details about activities of students in Department of Food Technology are needed to be explored in order to identify the related risk factors.

Limitations of the Investigation

Poor memory of students on their own history of vaccination for measles hampered effective data interpretation. The population of the analytic study was limited to only the first year students, so some risk factors could not be analyzed further. Too little information was available about measles outbreak and student activities in Chiang Mai.

No information about activities of students in Department of Food Technology was available to allow insights into all the risk factors. IgG test for all students could not be performed to get more accurate number of measles immunity among students. Therefore, the reported OR was likely to be underestimated, yet underscored the validity of conclusions.

Acknowledgement

The measles outbreak investigation in Mae Jo University campus in Rong Kwang District of Phrae Province was conducted jointly by an investigation team of IFETP Thailand, with great supports from public health authorities in relevant local offices: the Rong Kwang District Health Office, the Phrae Provincial Public Health Office, the Office of Disease Control and Prevention Region 10, and the Phrae campus of Mae Jo University.

The results of the investigation were contributed by all members of investigation team and Dr. Chuleeporn Jiraphongsa, the FETP Director, who was very active and instrumental in collecting information, performing analyses and contributing to completion of the investigation. The work is attributed to the IFETP Thailand.

Suggested Citation

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