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Sequential Clusters of Multidrug-resistant Cholera Cases in the Thai-Myanmar Border, 2015

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Abstract

A drug-resistant cholera outbreak occurred at the Thai-Myanmar border in April to May 2015. On 21 Oct 2015, the Bureau of Epidemiology was notified of a cholera outbreak in Mae Sot District, Tak Province. An investigation was conducted to confirm the outbreak, identify source of infection and provide control measures. Medical records were reviewed and all cases and contacts were interviewed. Active case finding was performed in the affected areas and nearby communities. Rectal swabs were collected and tested for *Vibrio cholerae* O1/O139. Water and food samples were tested for possible contamination. A series of three separate outbreaks of multidrug-resistant *V. cholerae* O1 El Tor Ogawa infection were identified in the same district. The first cluster occurred among Myanmar migrant workers in a garment factory. Poor hygiene was found among workers and food handlers. The second cluster occurred among persons from Myanmar in Mae Sot Subdistrict. The last cluster occurred among Thai while most of them joined a religious ceremony in Mae Pa Subdistrict. The outbreaks were confirmed as *V. cholerae* O1 Eltor Ogawa resistant to ampicillin, co-trimoxazole and tetracycline. Rapid response and improvement in hygiene were recommended.

Keywords: Cholera, outbreak, *Vibrio cholerae*, migrants, Thai-Myanmar border

Introduction

Cholera is an infectious disease caused by some strains of *Vibrio cholerae*.[1] Symptoms can range from none to severe.[2] The most common symptom is large amount of watery diarrhea that lasts for 2-3 days[3] while fever is rare[4]. In case of severe diarrhea, the patient may have severe dehydration and electrolyte imbalance within hours.[3] The incubation period is about two hours to five days.[2]

Cholera is spread mostly by water and food which have been contaminated with human feces.[3] Insufficiently cooked seafood is also a common source.[5] Risk factors for the disease include poor sanitation, lack of clean drinking water and poverty.[3]

Cholera can be diagnosed by a stool test or rectal swab culture.[3,6] Prevention involves improved sanitation and access to clean water.[7] The primary treatment is oral rehydration therapy.[3] In severe cases, intravenous fluid and antibiotics may be beneficial.[2] Antibiotics can shorten the course of the disease and reduce the severity of symptoms.[8]

Between May and October 2007, a cholera outbreak, involving biotype El Tor, serotype Inaba, took place in Mae Sot District.[9] The district shares the border with Myanmar for about 60 km. A large number of population from Myanmar migrated to work in the district due to political instability, widespread poverty and rapid growth of Thai economy in recent

years.[9] Cholera outbreaks sporadically occur in many parts of Thailand, especially in the border areas. Both Inaba and Ogawa serotypes were seen mostly from migrant workers.[10-12]

On 21 Oct 2015, the Bureau of Epidemiology (BOE) was notified by the Office of Disease Prevention and Control (ODPC) 2 of a cholera outbreak in Mae Sot District, Tak Province. The outbreak began among Myanmar workers in a garment factory (Factory X) on 14 Oct 2015 and then spread to nearby communities. The surveillance and rapid response team of BOE, ODPC 2, Tak Provincial Health Office, District Health Office and Mae Sot Hospital conducted an investigation on 22 Oct to 8 Dec 2015 to confirm the diagnosis and outbreak, identify cause and source of infection, and control the outbreak.

Methods

Review of Cholera Situation in Thailand and the Index Event

The event-based database of BOE was reviewed for details of previous outbreaks occurred during 2007 to September 2015. Data from investigations were reported into the database by local officers when case or outbreak occurred. Medical records of the index case at Mae Sot Hospital were also reviewed for clinical course, treatment and laboratory tests, including stool culture.

Active Case Finding

The target population were persons who lived in Mae Sot District during 4 Oct to 8 Dec 2015. We conducted a door-to-door search for cases in the district.

For the case definitions, a suspected case was a person who had at least three times of loose stool or at least one time of watery or bloody mucoid stool per day from 4 Oct to 8 Dec 2015. A confirmed case was a suspected case who was tested positive for *V. cholerae* O1 or O139 in stool or rectal swab by culture. A contact was a person or neighbor who lived or worked together with a confirmed case. An asymptomatic infected person was a person who had no diarrhea, but stool or rectal swab was positive for cholera bacteria. We interviewed all cases and contacts for history of illness and possible source of infection using an investigation form of BOE[13].

Laboratory Study

Rectal swabs were obtained from symptomatic cases, food handlers and contacts in the communities. The specimens were transported in Cary-Blair transport media and sent to Mae Sot Hospital within four hours for bacteriological culture. The results were reported within 24 hours. Drug sensitivity for ampicillin, tetracycline, co-trimoxazole, chloramphenicol and norfloxacin was tested by the standardized disc method[14] if the organism was found. According to the Medical Laboratory Unit in Mae Sot Hospital, drug resistance was defined when the zone of growth inhibition around each of the antibiotic disk was less than 19 mm for ampicillin, less than 15 mm for co-trimoxazole, less than 14 mm for tetracycline, less than 20 mm for chloramphenicol and less than 12 mm for norfloxacin.

All available food specimens in the canteen of Factory X during the field investigation were collected and cultured for possible cholera contamination. Samples of drinking water and water for washing from the cases' residences and the nearby market were collected using purposive sampling, and tested for cholera contamination and chlorine level.

Environmental Observation

We conducted an environmental survey in the affected areas and nearby communities using a walk-through survey method, and recorded in a checklist. We interviewed and observed cases for behaviors such as eating, toilet use and hand washing. We also observed source of drinking water, water for washing, and water privy and bin.

Results

Situation of Cholera in Thailand

There were total 427 outbreaks of cholera, with 1,673 affected individuals had been reported through the event-based database of BOE during 2007 to September 2015. Major outbreaks of cholera mostly occurred among factory workers and migrants along border areas (Figure 1).

Description of Index Case

The index case was a 48-year-old Myanmar female, with no underlying disease. She worked as a seamstress in Factory X, a garment factory in Mae Sot District. There were 296 Myanmar workers sewing in this factory. On 17 Oct 2015, she had watery diarrhea for 4-5 episodes, no fever, mild nausea and vomiting, dehydration and fatigue. She went to Mae Tao Clinic on the same day. Rectal swab culture was not done. She had no history of travel within a month and met no one outside the village. She informed that she had consumed the left-over curry cooked by herself a day before she got sick.

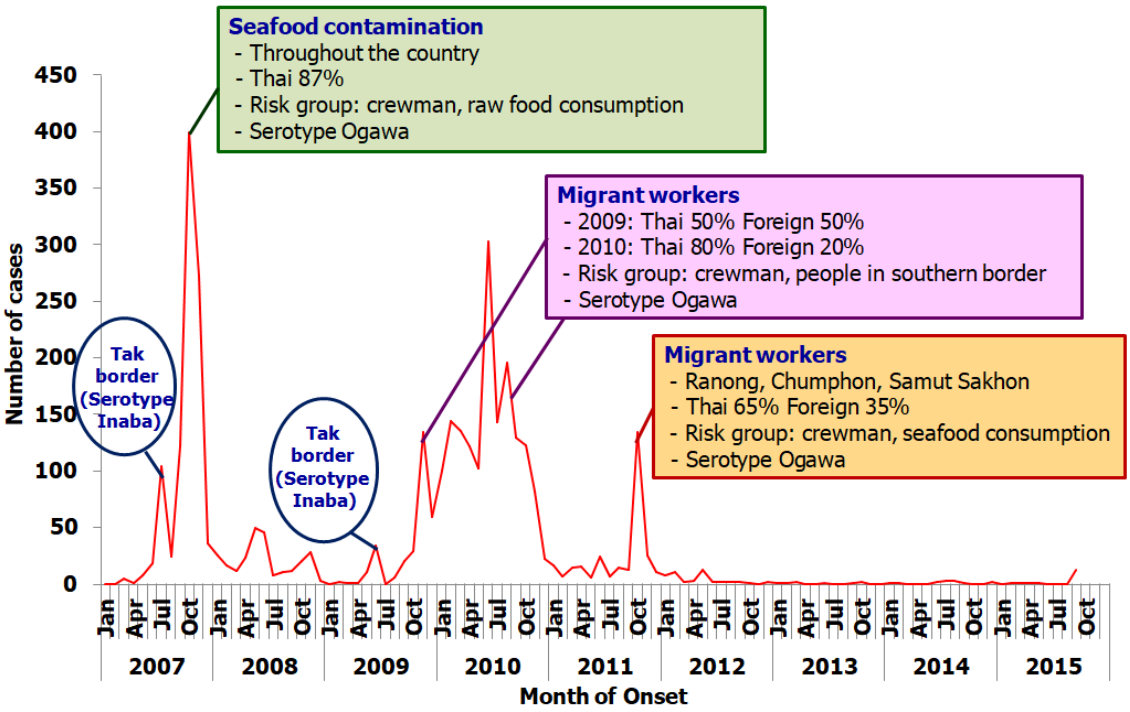

Figure 1. Major outbreaks of Cholera in Thailand. January 2007 - September 2015

Active Case Finding

The outbreak was divided into three clusters (Figures 2 and 3).

First cluster (In Factory X and nearby communities)

The first cluster occurred among Myanmar workers in Factory X, Phra That Pha Deang Subdistrict during 12 to 27 Oct 2015. Totally 220 people were included in the investigation: 209 out of 296 workers, six family members and five food handlers. There were 22 suspected cases (two cases were admitted) and all of them were workers. Total attack rate was 10.5% (22/209). The median age was 22 years (Interquartile range, IQR 9). No one had history of travel within one month. However, one worker informed us that his relatives from Kayin State in Myanmar just came to visit him. There were no symptomatic cases among the people who lived around the factory.

Second cluster (Car service center near Pa Chareon Market)

The second cluster occurred in a car service center near Pa Chareon Market, Mae Sot Subdistrict during 3-9 Nov 2015. There were 45 people in this area. All were also from Myanmar. Three suspected cases were found. No one was admitted. Attack rate was 6.7% (3/45). The first case went to Phra That Pha Deang Subdistrict, where Factory X is located, before the illness. However, the case did not meet anyone in the factory and no solid evidence of linkage between the two clusters could be identified.

Third cluster (In Mae Pa Subdistrict)

The last cluster occurred among people who joined a religious ceremony at Pai Lom Temple, Mae Pa Subdistrict during 13-28 Nov 2015. Eight suspected cases were identified from total 30 people who joined the ceremony and had lunch together at the temple. Attack rate was 26.7% (8/30). No one was admitted. All were Thai. The median age was 50 years (IQR 14). One additional suspected case was found through active case finding in a nearby temple in the same subdistrict. He came from Phitsanulok Province for a seminar. He did not join the religious ceremony in Mae Pa Subdistrict. Other people participated in the same event could not be traced.

Laboratory Study

First cluster

Rectal swabs were collected from 220 people in the factory, including 22 suspected cases, 193 contacts and five food handlers. Twenty out of 22 suspected cases and seven out of 193 contacts were positive for *V. cholerae* O1, El Tor Ogawa (resistant to ampicillin, co-trimoxazole and tetracycline) while all 27 with the positive results were workers. Rectal swabs from five food handlers were negative for cholera infection.

Less than 0.2 ppm of residual chlorine was detected from five samples of drinking water and eight samples of washing water from the factory. Ten samples of tap water, pond water and groundwater from community around the factory were tested and revealed no chlorination. No cholera was found from the samples of food and water collected.

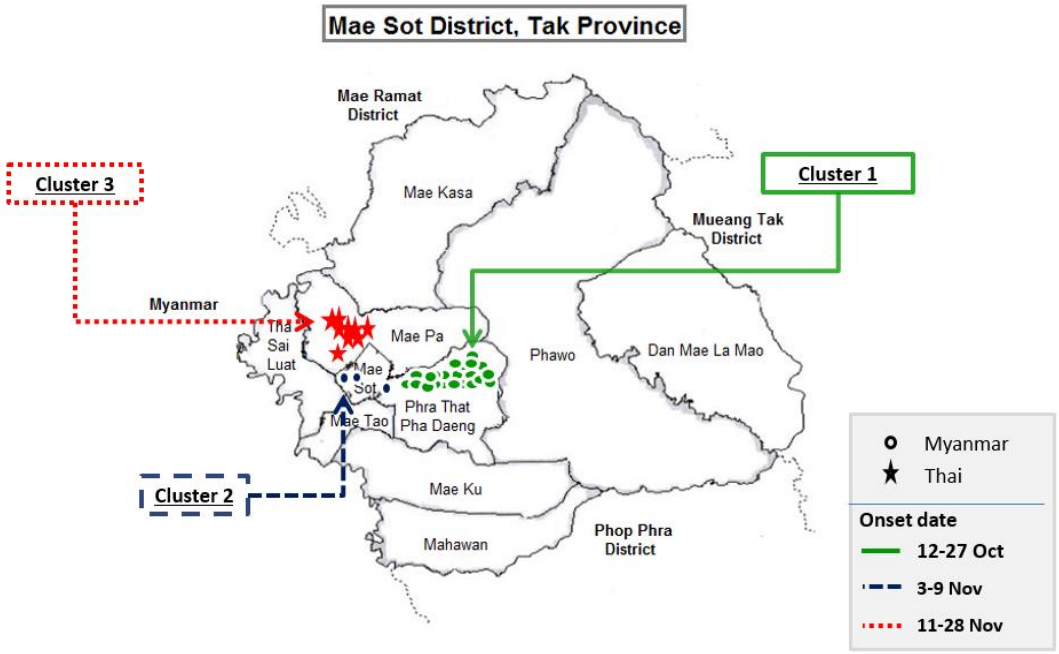

Figure 2. Cholera Cases in Mae Sot District, Tak Province, Thailand, 12 October - 28 November 2015

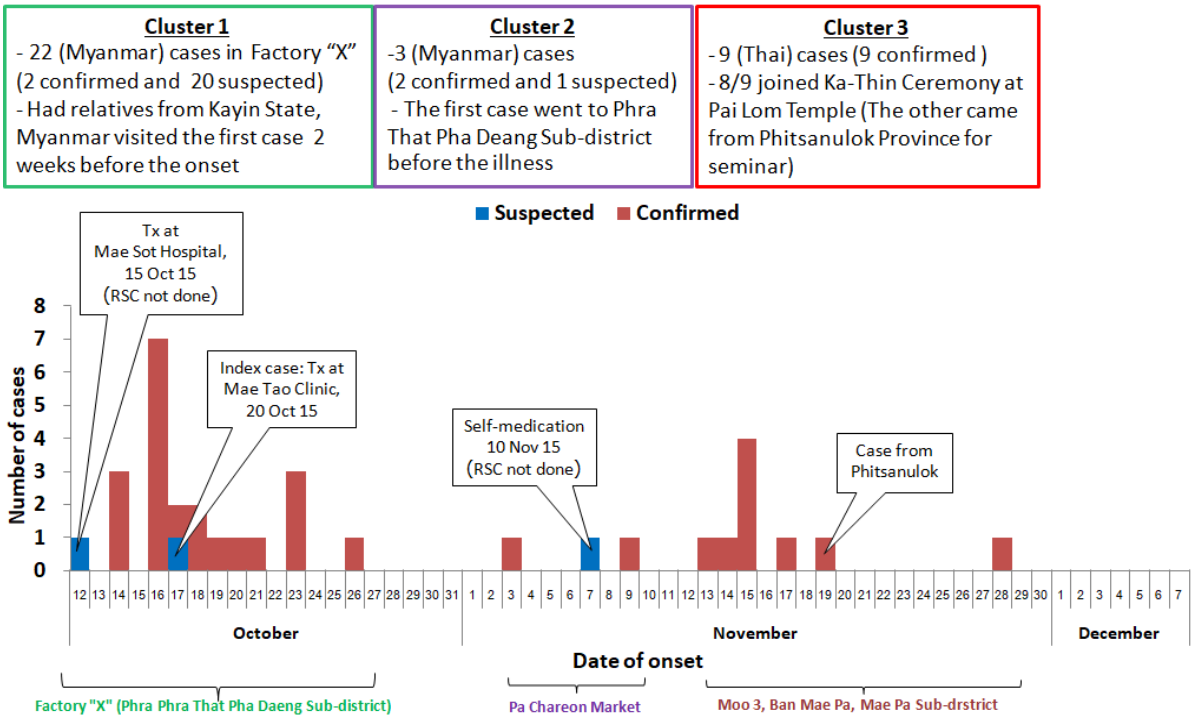

Figure 3. Cholera Cases in Mae Sot District, Tak Province, Thailand, 12 October - 8 December 2015

Second cluster

Rectal swabs were collected from two out of three suspected cases in the car service center. Both were positive for *V. cholerae* O1, El Tor Ogawa (resistant to ampicillin, co-trimoxazole and tetracycline). Rectal swabs from 42 contacts were negative for cholera infection.

Food specimens were not available for testing. No residual chlorine was detected from two samples of drinking water and two samples of washing water. No cholera was found in the samples of water collected.

Third cluster

Rectal swabs were collected from 30 persons who attended the ceremony. Nine were positive for *V. cholerae* O1, El Tor Ogawa (resistant to ampicillin, co-trimoxazole, and tetracycline).

All rectal swab specimens from 21 contacts were tested negative for cholera infection. However, rectal swab of a suspected case from a nearby temple was positive for *V. cholerae* O1, El Tor Ogawa which was resistant to ampicillin, co-trimoxazole and tetracycline as well.

No left-over food was available for laboratory testing. No chlorination was detected from three samples of tap water in the temple and five samples of washing water. No cholera was found from the samples of water collected.

Environmental Observation

First cluster

Most of the workers consumed food with their hands, shared the spoons and did not wash their hands before eating. They usually ate the left-over food from the previous meals without reheating. Food handlers used bare hands in preparation of food, wore neither head cover nor apron, and did not wash their hands after using toilet. The workers drank tap water without boiling. They also used tap water for washing. Water privy with poor sanitation and inadequate washing sinks and soap were used. There were inadequate trash bins and most of them did not have the cover.

People lived around the factory used tap water, pond water and groundwater. One community in this subdistrict used untreated water from the pond which was about 30 meters away from the factory.

Second cluster

Most persons also ate food with their hands, shared the spoons, and did not wash their hands before eating and after using toilet. They usually cooked food for themselves meal by meal. They used tap water without boiling for drinking and washing. They also used water privy with poor sanitation.

Third cluster

In this event, people cooked different menus at home and brought to the temple to offer foods to monks for a religious ceremony. Afterwards, they gathered and consumed the foods together. No foods were prepared at the temple. Most of them used bottled water for drinking and village tap water for washing. Some of them used pond water and groundwater. They used good sanitation water privy. Although there were adequate trash bins in this area, some of them were not covered.

Actions Taken

Non-pharmaceutical Interventions

We educated the workers, food handlers and the public to improve sanitation such as immediately eating of cooked food, reheating the left-over food before eating, washing hands before eating and after using toilet, boiling water for drinking, chlorinating the public water, and disinfecting the environment using benzalkonium chloride and hypochlorite. We also contacted Phitsanulok provincial health office to follow up the case who came from Phitsanulok Province.

Pharmaceutical Interventions

After rectal swabs were taken, chemoprophylaxis (3-day oral norfloxacin in non-pregnant or erythromycin in pregnant) was given to those who had positive culture for cholera (34 cases and 7 asymptomatic persons) and were followed up for adequate management. Repeated testing of rectal swabs was performed after completion of treatment until all negative results were obtained.

Discussion

This event was considered to be an outbreak due to sudden increase in cholera cases with epidemiological linkage between cases occurred in nearby subdistricts; however, there was no clear linkage among these three clusters. Cholera outbreak usually occurred in crowded living conditions such as in migrant workers camps, as seen in this factory. Moreover, sanitation and hygiene were also inadequate[15,9,16-17] among the cases. The infection could spread to nearby communities same as previous outbreaks in this area.[9]

Although we could not identify the exact sources of infection, it was found that cholera could spread across the Thai-Myanmar border, as seen in the previous outbreaks in this area.[9] All three outbreaks revealed the same organisms with similar drug sensitivity.

Food handlers often play a major role in foodborne disease, spreading through poor food handling techniques.[18,19,20] However, all food specimens in this outbreak were negative for cholera. It might be due to multiple sources of foods in the factory, the ceremony, and all families. Furthermore, this outbreak might be associated with waterborne transmission due to inadequate concentration of residual chlorine though all water specimens were negative for cholera.

The reason of delayed detection of the outbreak might be due to limited access to medical care services among the migrants. Some cases in the first cluster did not visit public health facilities, as found similarly in previous outbreaks[9,18,21].

The cholera pathogen might have been spread from the recent outbreaks along the Thai-Myanmar border, as the first confirmed case of 2015 in Tak Province was found on 4 Sep 2015 in Umphang District.[10] Rectal swab culture revealed *V. cholerae* O1, El Tor,

Ogawa (resistant to ampicillin, co-trimoxazole and tetracycline). Furthermore, in October 2015, 12 villagers had died and 61 villages suffered from cholera outbreak in Kawkareik and Kyain Seikgyi Townships near the Thai-Myanmar border in Kayin State, Myanmar.[22]

Limitations

We had some limited permission for investigation from the factory's owner due to illegal employment of their workers. In addition, some workers were not cooperative due to poor insight or misunderstanding about the disease.

Some cases had taken self-medication before rectal swabs were conducted, and this could have resulted in false negative tests. Some suspicious foods could not be collected for testing. Furthermore, genetic lineage of pathogens from the three clusters had not been proved for its similarity.

For disease control, chlorination could not be done in all water supplies. Food reheating was quite difficult for the workers in the factory.

Language barrier was a major problem and could cause miscommunication between public health officers and the migrants.

Public Health Recommendations

Communities

Migrant workers were encouraged to go to hospital or health promotion hospital for proper management.

The factory's owner and all workers were educated about importance of outbreak investigation and control. The factory's owner was also encouraged to provide instruments for reheating food or inform food sellers to provide only single-served portion of food so that the workers could finish them within one meal without any reheating process needed.

Health Sectors

The Provincial Waterworks Authority was contacted for adequate chlorination of tap water. People were educated about the disease and encourage them to improve sanitation, and monitor the situation until the outbreak was controlled.

Migrant health volunteers should be trained for translating and assisting in disease prevention and control.

Conclusions

This cholera outbreak occurred among Myanmar migrant workers in a garment factory and extended to nearby communities in Mae Sot District, Tak Province. Multidrug-resistant *V. cholerae* O1, El Tor Ogawa was the pathogen in this outbreak which might be related to the recent outbreaks in Umphang District, Tak Province. Rapid response and appropriate control measure were the keys of success in this outbreak control.

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Suggested Citation

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