

# An Outbreak of Cholera among Migrants Living in a Thai-Myanmar Border Area

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**Objective:** To study epidemiologic characteristics of a cholera outbreak involving mainly Myanmar migrants living in overcrowded conditions with poor sanitation in a Thai-Myanmar border district, in 2007.

**Material and Method:** Both passive and active case surveillances were carried out in Mae Sot District, Tak Province since the beginning of the outbreak. Samples of various types of drinking and non-drinking water from the infected areas, communal waters, and some selected foods were analyzed for the presence of cholera contamination. A case-control study was conducted to determine the vehicle of cholera transmission among Myanmar migrants in one municipal community with a cluster of 72 cholera cases. Preventive and control measures were primarily carried out by trained migrant health volunteers and workers.

**Results:** Between May and October 2007, 477 cholera cases of biotype El Tor, serotype Inaba, were identified in the district. The majority of them (93.1%) were detected by active case surveillance in the communities. None died in this outbreak. Most (84.9%) were Myanmar migrants and the remainder were local Thai residents. The infection rates of cholera were significantly greater in communities with known passive cases than in those with no such cases. Three samples of sea food illegally imported from Myanmar were positive for cholera of the same biotype and serotype. Fifteen of 324 (4.6%) food handlers in the district were found to carry *V. cholerae* O1. A case-control study in one municipal community revealed a significant association between infection and frequently having food purchased from one infected food handler.

**Conclusion:** Active case finding and implementation of control measures by the assistance of trained migrant health volunteers and workers might reduce the morbidity and mortality in this population.

**Keywords:** *V. cholerae*, Cholera, Outbreak, Migrant, Thai-Myanmar border

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Diarrheal diseases, including cholera, are leading causes of morbidity and mortality among displaced populations primarily due to overcrowding, inadequacy of water supply, and poorly maintained sanitation facilities<sup>(1-12)</sup>. Outbreaks of cholera have been frequently reported among such displaced persons and sometimes have caused a serious public health problem to residents of the hosting countries. In addition to fleeing from civil conflicts and natural

disasters, people can leave their home country to seek economic betterment. The present study paper reports epidemiologic characteristics of a cholera outbreak among Myanmar migrants living in a Thai-Myanmar border area, and emphasized the usefulness of migrant health workers and volunteers for preventive and control activities.

Between May and October 2007, a cholera outbreak involving biotype El Tor, serotype Inaba, took place in Mae Sot District, Tak Province, northwestern Thailand. Only 6 cases of cholera had been reported from this district in 2005 and none in 2006. All cholera isolates in recent years were of biotype El Tor, serotype

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Ogawa. The district shared 60 km border with Myanmar by the Moei River. Because of political instability and widespread poverty in Myanmar and the rapid growth of the Thai economy in recent years, a large number of people migrated from Myanmar to work in the district. This outbreak affected mainly Myanmar workers and their families who lived in this border area. An outbreak investigation and implementation of preventive and control measures were carried out.

## **Material and Method**

### ***Study areas and population***

The total Thai population in Mae Sot District in 2007 was 132,273, and 80.7% of them lived in the rural villages outside the municipality. The district was served by 22 health centers, distributed throughout the rural area, and a general hospital with 317 beds, located in the municipality. The district had 14 municipal communities and 88 rural villages in 2007. According to the Thailand Primary Health Care Program, each municipal community and rural village in Mae Sot had 5-40 trained community/village health volunteers (VHVs), each of whom was responsible for about 10-15 households. The VHVs were trained primarily to educate their neighbors and assist health personnel in matters of preventive and promotional health care.

It was estimated that about 100,000 Myanmar migrants lived in the district in 2007 but only 21,337 were registered for work permits with health insurance. Many migrants lived in overcrowded houses or simple shelters provided by the employers or built by themselves, with poor sanitation. Because of the illegal status and very low family income, Myanmar migrants had limited access to healthcare services. Although there was one non-governmental organization (NGO) clinic providing healthcare services free of charge to the migrant population in the district, it had limited medical facilities. These problems might contribute to the high incidence of communicable diseases, malnutrition, and pregnancy-related morbidity and mortality among displaced persons, compared to the local Thai residents<sup>(13-16)</sup>.

To reduce the public health problems in this population, the Mae Sot District Health Office and the hospital organized a primary health care program in recent years, with the purpose of providing health education and simple primary care services to the migrants such as immunizations for pregnant women and children, family planning services, and condom promotion. In the district in 2007, all the 14 municipal communities and 29 of the 88 (33.0%) rural villages,

where migrants aggregated, had trained migrant health volunteers (MHVs) whose activities were similar to those of the Thai VHVs. However, these preventive and promotional health activities were not fully effective due to limited financial support and the illegal status of MHVs. The district health office and the hospital had employed some migrant health workers who were trained to provide technical support to the MHVs and follow their activities. In 2007, there were 533 trained MHVs and 17 migrant health workers in the district.

### ***Outbreak investigation***

Both passive and active case surveillances were carried out in the district since the beginning of the outbreak. All diarrheal cases in the hospital, health centers, and the NGO clinic were screened for cholera infection by rectal swab culture (passive case surveillance). Active case surveillance was promptly conducted in the district for early detection and treatment. A case of diarrhea was defined as any person who had  $\geq 3$  loose stools or  $\geq 1$  watery or bloody mucoid stools per day. Rectal swab specimens were obtained from any person with diarrhea, family members and neighbors of the infected households, and food handlers in the communities. Specimens were transported in Cary-Blair transport media and sent to Mae Sot General Hospital within 4 hours of collection for bacteriological identification.

Samples of various types of drinking and non-drinking water (100 ml/specimen) from the infected areas, communal waters, and some selected foods (200 gm or 200 ml/specimen) were cultured for the presence of cholera contamination. All clinical and environmental specimens were subjected to the enrichment procedure using alkaline peptone water. Antibiotic sensitivity was determined by the standardized disc method<sup>(17)</sup>. Cholera isolates were randomly submitted to the Department of Medical Sciences, Thailand Ministry of Public Health, for laboratory quality control.

A case-control study was conducted to determine the vehicle of cholera transmission among Myanmar migrants in one municipal community with a cluster of 72 cases (40 symptomatic and 32 asymptomatic) between June 14 and 22, 2007. Only adult symptomatic cases aged 15 years and older were included in the case-control study to reduce the possibility of recall bias frequently observed in children. Controls were neighbor adults who had had no diarrhea within the previous month and were negative for cholera by rectal swab culture on June 24, 2007.

Cases and controls were asked about their consumption of food, water for drinking and non-drinking, history of a visit and having meals in Myanmar, and having a visitor from Myanmar in 5 days before and during the outbreak.

Since the outbreak affected mainly the migrant population, the authors organized mobile teams with the purpose of active case finding and provision of preventive and control measures in these migrants. Each team comprised one or two Thai health personnel (from the hospital or the local health center) and one or two migrant health workers. The MHVs helped to deliver the health message, to identify persons with diarrhea, their family members and food handlers, and to assist health personnel to improve sanitation and environment in their communities. In areas with no MHVs, such activities were done by the Thai VHV and some migrants who agreed to be the health assistants. Health education materials, mainly the leaflets and posters, in Myanmar language were widely disseminated to these migrants.

## Results

### *Epidemiological characteristics*

Between May and October 2007, 477 bacteriologically confirmed cholera cases were identified in the district (Table 1). The majority of them (93.1%) were detected by active case surveillance in the communities. Only 6.9% were those with diarrhea who sought medical treatment in any healthcare center (passive case surveillance). Of the 173 symptomatic cases detected by active case finding, 12 (6.9%) (all Myanmar) had severe dehydration and were referred to the hospital for rapid fluid replacement. None died in this outbreak. However, there might have been some cholera deaths in the very remote areas that could have escaped from the reporting system. Of the 477 cases, 84.9% were Myanmar migrants and the remainder were local Thai

residents. Only 10.4% of the Myanmar cases were registered workers. The distributions of cases by surveillance in both populations were comparable.

All isolates were *Vibrio cholerae* O1, biotype El Tor, serotype Inaba. They were susceptible to tetracycline (100%), norfloxacin (100%), and ampicillin (89.9%), but resistant to co-trimoxazole, and chloramphenicol. Tetracycline, doxycycline, or norfloxacin was used for the treatment of the cases. Tetracycline or doxycycline was given to their household contacts.

Fig. 1 illustrates the number of cases by date of onset. The first two cholera cases (one Thai and one Myanmar) developed clinical symptoms on May 3 and 4, 2007. The Thai case was a local resident living in a frontier village and contracted cholera after a 3-day visit to Myanmar. The other case was a Myanmar resident who crossed the border for daytime work in a Thai factory located in this village. Subsequently, 194 cases were reported between June 5 and August 15, 2007. Thereafter, 10 cases were sporadically reported until October 14, 2007. No cholera cases were detected between October 15 and December 31, 2007.

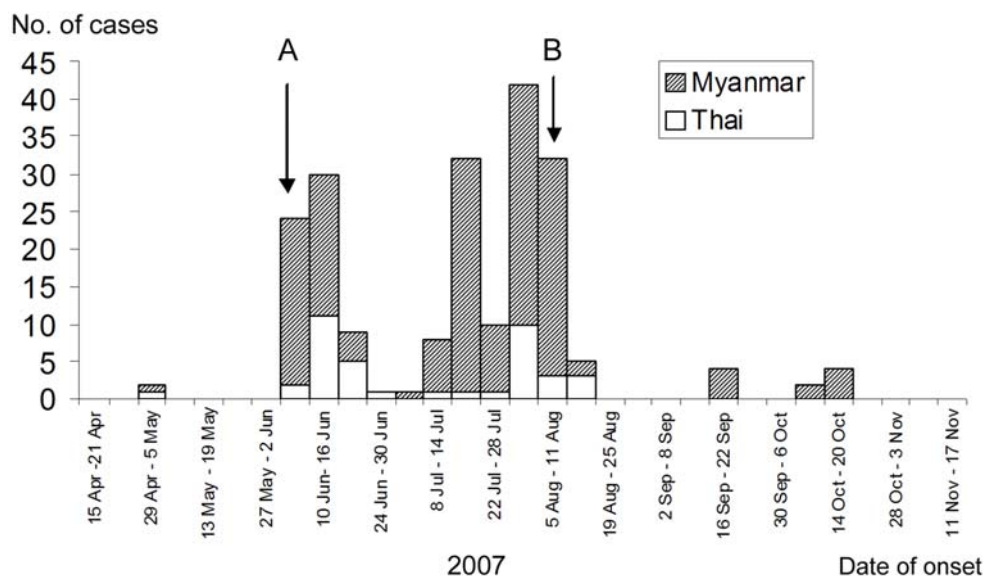
The outbreak affected all age groups in both Thai and Myanmar populations (Table 2). About 57% of the Myanmar cases were 15-44 years old compared with 26.4% of the Thais. Female cases were slightly more frequent than male cases in both populations. The majority of the Thai cases (87.5%) lived in the villages outside the municipality compared with 42.7% of the Myanmar cases. The attack rates by age, sex, and address could not be compared between both populations due to lack of demographic data of Myanmar migrants.

Of the 477 cases, 177 (37.1%) were detected by active case surveillance in the communities with no cases seeking medical treatment in any healthcare center (passive cases) before the activity of active case finding. Table 3 compares the infection rates of

**Table 1.** Number and percentage of cholera cases, by case detection and nationality, Mae Sot District, Tak Province, 2007

Case detection	Thai		Myanmar		Total	
	No.	%	No.	%	No.	%
Symptomatic cases detected in healthcare centers	8	11.1	25	6.2	33	6.9
Symptomatic cases detected in communities	31	43.1	142	35.1	173	36.3
Asymptomatic cases detected in communities*	33	45.8	238	58.8	271	56.8
Total	72	100.0	405	100.0	477	100.0

\* Among household contacts, neighbors, and food handlers



A: Active case findings and control measures in infected and nearby communities  
 B: Active case findings and control measures throughout the district

**Fig. 1** Cases of cholera, by date of onset and nationality, Mae Sot District, Tak Province, 2007

**Table 2.** Number and percentage of cholera cases, by age, sex, address, and nationality, Mae Sot District, Tak Province

Age/sex/address	Thai		Myanmar		Total	
	No. of cases	%	No. of cases	%	No. of cases	%
Total	72	100.0	405	100.0	477	100.0
Age (years)						
< 5	21	29.2	80	19.8	101	21.2
5-14	17	23.6	81	20.0	98	20.5
15-24	4	5.6	100	24.7	104	21.8
25-34	8	11.1	96	23.7	104	21.8
35-44	7	9.7	35	8.6	42	8.8
≥ 45	15	20.8	13	3.2	28	5.9
Sex						
Male	34	47.2	180	44.4	214	44.9
Female	38	52.8	225	55.6	263	55.1
Address						
Municipality	9	12.5	232	57.3	241	50.5
Villages	63	87.5	173	42.7	236	49.5

cholera by active surveillance between communities with and without known passive cases. The infection rates of both symptomatic and asymptomatic cholera were significantly greater in communities with known passive cases than in those with no such cases. Similar patterns were observed in both municipal communities

and villages. It was noticed that the infection rate was higher in municipal communities than in villages.

#### **Environmental investigations**

Living conditions of the migrant population in the municipality were poorer than in the villages.

**Table 3.** Comparison of infection rates of cholera by active surveillance between communities with and without cholera cases detected in healthcare centers (passive cases)

Active surveillance	Communities with known passive cases			Communities without known passive cases			Ratio (95% CI)*
	No. examined	No. infected	%	No. examined	No. infected	%	
<b>Municipal communities</b>							
Symptomatic	95	61	64.2	112	24	21.4	3.0 (2.0-4.4)
Asymptomatic**	284	77	27.1	514	45	8.8	3.1 (2.2-4.3)
Total	379	138	36.4	626	69	11.0	3.3 (2.6-4.3)
<b>Villages</b>							
Symptomatic	176	31	17.6	462	57	12.3	1.4 (1.0-2.1)
Asymptomatic**	1,177	98	8.3	1,248	51	4.1	2.0 (1.5-2.8)
Total	1,353	129	9.5	1,710	108	6.3	1.5 (1.2-1.9)
<b>Total</b>							
Symptomatic	271	92	33.9	574	81	14.1	2.4 (1.9-3.1)
Asymptomatic**	1,461	175	12.0	1,762	96	5.4	2.2 (1.7-2.8)
Total	1,732	267	15.4	2,336	177	7.6	2.0 (1.7-2.4)

\* Ratio of infection rates between communities with and without known passive cases

\*\* Asymptomatic household contacts, neighbors, and food handlers

**Table 4.** Percentage of environmental specimens positive for cholera during the outbreak, Mae Sot District, Tak Province

Specimen	No. examined	No. positive	%
Public piped water	86	0	0.0
Bottled water	36	0	0.0
Well water	15	0	0.0
Water for washing from the infected house	64	1	1.6
Ice	39	0	0.0
Raw food	132	3	2.3
Cooked food	74	0	0.0
Environmental swabs	139	1	0.7
Total	585	5	0.9

Many in the city lived in overcrowded houses/shelters with insufficient water supply and sanitation whereas many of factories commonly located in the villages provided accommodation to workers although normally it was also crowded. There were public piped water systems in most areas of the district. None of the drinking water and ice samples collected during the outbreak were positive for *V. cholerae* O1 (Table 4). However, no residual chlorine was detected in five of the eight samples of public piped water. One sample of non-drinking water from the infected house and three samples of raw food were positive for cholera of the same biotype and serotype. The three contaminated food samples consisted of sea food illegally imported from Myanmar and were screened at the river pier

before distribution for sale. All 56 persons involving this seafood trade had negative stool culture for cholera. This illegal seafood trade was interrupted during the outbreak. One environmental sample swabbed from a chopping block in the Mae Sot market was culture-positive for cholera. The food handler who was the owner of this block and her family members had no cholera organisms in their stools.

#### Case-control study

The case-control study included 22 cases and 44 controls, all migrants, who were asked about their consumption of food, water for drinking and non-drinking, history of visit and meals in Myanmar, and having a visitor from Myanmar in the previous

five days before and during the outbreak. The only significant difference between cases and controls was a history of frequently having food purchased from one food handler in their community (15 of 22 cases and 17 of 44 controls, odds ratio = 3.4, 95% confidence interval = 1.0-11.7). This suspected food handler had a positive stool culture for cholera of the same biotype and serotype.

#### **Surveillance of food handler**

In the district, 324 food handlers were screened for cholera infection. Fifteen (4.6%) (1 symptomatic and 14 asymptomatic) were culture-positive for the organism. The investigations could not determine an increased risk of infection related to the infected food handlers, except for the case-control study and the isolation of *V. cholerae* from samples of sea food.

#### **Control measures**

Control measures included (i) active case finding for early detection and treatment, (ii) chlorination of the water supply, (iii) improvement of sanitation in the areas, including fly control, (iv) screening of food handlers and treatment of infected ones, (v) environmental surveillance of drinking and non-drinking water, ice, and some selected foods in the infected areas and the market, and (vi) intensive health education of the infected families, food handlers, and people in the communities. Control measures were implemented in the infected and nearby communities since the beginning of the outbreak and then throughout the district, where migrants aggregated, in early August 2007. The outbreak subsequently tapered off after implementation of control measures throughout the district. All preventive and control activities were financially supported by the Thailand Ministry of Public Health and the Tak Provincial Office.

#### **Discussion**

Crowded living conditions, inadequate clean water supplies, and poor sanitation facilities contribute to the spread of cholera among displaced populations<sup>(1,3-6,8-12)</sup>. In this outbreak, these factors were more prevalent in the municipal communities than in the villages. Therefore, they might have contributed to more cholera cases among Myanmar migrants living in the municipality, than among local Thai residents. The greater proportion of cases aged 15-44 years old in Myanmar persons than Thais might be due to a high proportion of migrants in the working age group.

Cholera outbreaks in displaced persons can be made worse by limited access to medical care services. In this outbreak, many symptomatic cholera cases did not seek treatment although some of them had severe dehydration and required rapid fluid replacement. Early detection and treatment of infected persons by active case finding might reduce the morbidity and mortality among migrants. Active case surveillance should cover all the migrants at risk who normally have poor access to healthcare services. The present study revealed the high infection rates of cholera in communities without known passive cases although the rates were lower than in those with such cases.

Besides movement of infected persons, cross-border food trade may be a possible source of cholera spread from one country to neighboring countries. The isolation of cholera organisms from sea food illegally imported from Myanmar during the outbreak suggests another way of transmission across borders although the correlation of infection with consumption of sea food could not be verified. Sea food has been implicated repeatedly as a vehicle of cholera infection in many studies<sup>(18-26)</sup>. The increase in food trade across borders underscores the need for risk assessment and disease surveillance.

In the outbreak, food handlers were at risk of cholera infection as well as other persons in the community. Without early treatment of infected persons and health education, food handlers might have contributed to further food-borne spread through poor food handling techniques. Outbreaks of food-borne cholera have been traced to infected food handlers<sup>(26-29)</sup>. The case-control study also revealed such an association. The authors recommend that control measures for a community cholera outbreak should include health education and surveillance for infection among food handlers in the infected area.

Since most cases of El Tor cholera have asymptomatic or have mild to moderate diarrhea, control of movement of infected persons across borders may not be effective. Moreover, in this area persons could cross the border easily through numerous unofficial entry points. To control such an outbreak in both sides of the border, good cooperation and support between countries are essential.

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## การระบาดของอหิวาตกโรคในชาวต่างชาติในพื้นที่ชายแดนไทย-พม่า

วิทยา สวัสดิวิภูผิงศ์, โชคชัย งามทรายทอง, พงษ์พจน์ เปี่ยมน้ำล้อม, ศรีวรรณ หาญณรงค์

**วัตถุประสงค์:** เพื่อศึกษาลักษณะทางระบาดวิทยาของอหิวาตกโรค ที่ระบาดในชาวต่างชาติที่อาศัยอยู่ในชุมชนแออัด อำเภอชายแดนไทย-พม่าแห่งหนึ่ง ปี พ.ศ. 2550

**วัสดุและวิธีการ:** ดำเนินการเฝ้าระวังโรคทั้งในสถานบริการสาธารณสุขและค้นหาผู้ป่วยเชิงรุกในชุมชน อำเภอแม่สอด จังหวัดตาก เฝ้าระวังสิ่งแวดล้อมโดยการสุ่มตรวจน้ำและอาหารในพื้นที่ และดำเนินการศึกษา case-control study ในชุมชนเขตเทศบาลแห่งหนึ่งซึ่งพบผู้ติดเชื้อรวม 72 ราย เพื่อค้นหาแหล่งโรคและการถ่ายทอดโรค สำหรับการควบคุมและป้องกันโรคส่วนใหญ่แล้วดำเนินการโดยพนักงานสาธารณสุขและอาสาสมัครสาธารณสุขชาวต่างชาติ

**ผลการศึกษา:** ในช่วงเดือนพฤษภาคมถึงตุลาคม พ.ศ. 2550 พบผู้ติดเชื้ออหิวาตกโรคชนิด *El Tor*, *Inaba* รวม 477 ราย โดยส่วนใหญ่ (ร้อยละ 93.1) ได้จากการค้นหาผู้ป่วยในชุมชน ไม่พบผู้เสียชีวิต ร้อยละ 84.9 เป็นชาวต่างชาติ และที่เหลือเป็นชาวไทย ในชุมชนที่มีผู้ป่วยมารับการรักษาในสถานบริการสาธารณสุข จะมีอัตราการพบผู้ติดเชื้อสูงกว่าชุมชนที่ไม่มีผู้ป่วยมาสถานบริการอย่างมีนัยสำคัญทางสถิติ จากการสุ่มตรวจอาหารพบการปนเปื้อนเชื้ออหิวาตกโรคชนิดเดียวกันในอาหารทะเล 3 ตัวอย่างที่ลักลอบนำเข้าจากประเทศพม่า ผู้ประกอบอาหารในพื้นที่ 15 ราย (ร้อยละ 4.6) จาก 324 ราย ตรวจพบเชื้ออหิวาตกโรคในอุจจาระ จากการศึกษาคase-control study พบความสัมพันธ์ระหว่างการติดเชื้ออหิวาตกโรคกับการรับประทานอาหารจากผู้ประกอบอาหารที่ติดเชื้อ

**สรุป:** การค้นหาผู้ป่วยในชุมชน และการควบคุมและป้องกันโรคที่รวดเร็ว ด้วยความช่วยเหลือของพนักงานสาธารณสุขและอาสาสมัครสาธารณสุขชาวต่างชาติ ช่วยลดการป่วยและเสียชีวิตจากการระบาดของโรคในประชากรชาวต่างชาตินี้ลงได้