



Outbreak, Surveillance and Investigation Reports

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Cholera Outbreak in Village A, Tanjung Keling, Melaka, 2007

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Abstract

On 28 Feb 2007, a cholera case was notified from Village A, Melaka, Malaysia. An epidemiological investigation was conducted to assess the extent of the outbreak and establish control measures. Active case detection was conducted among the case's family and neighbors, work contacts and related food handlers. Passive case detection was enhanced in 10 nearby clinics in the area. A case was defined as a person who developed at least three episodes of watery diarrhea with *Vibrio cholerae* positive stool culture. A case control study was done to identify risk factors. Controls were healthy household members or neighbors with stool culture negative for *Vibrio cholerae*. Water and food samples were taken for bacterial analysis. Control measures were immediately initiated and followed up. One hundred and forty two contacts were screened. Seven new diarrhea cases with epidemiological link were detected, clustered among two families with one positive stool culture with no fatality. All cases were Malays; six males and two females. Fifty percent had history of eating ice desserts prepared unhygienically by an infected food handler. Cases were seven times more likely to consume an ice dessert (95% CI = 1.1-44.1). No other food items or water sources were implicated. Immediate control measures effectively contained the outbreak.

Keywords: cholera outbreak, *Vibrio cholerae*, familial clustering, ice dessert.

Introduction

Cholera is an acute bacterial infection of the intestine caused by ingestion of food or water containing *Vibrio cholerae*, serogroup O1 or O139. Its incubation period is from less than one day to five days. The bacteria release an enterotoxin that usually causes painless and copious watery diarrhea. The sudden loss of body fluid can result in severe dehydration. If left untreated, death can occur within hours¹. Most persons infected with *V. cholerae* are asymptomatic, and the bacteria may be present in their feces for seven to 14 days. Less than 20 percent of ill persons develop the typical rice-water stools with moderate to severe dehydration². Cholera is communicable if the bacteria are present in the stool. Although rare, an asymptomatic carrier state may persist for several months³.

Cholera case fatality rates as high as 50 percent can occur in an unprepared community⁴. With proper oral or intravenous rehydration treatment, the case fatality rate is less than one percent^{1,5}.

An epidemic occurs when a community or region has an increase of people with an illness, a specific health related behavior, or another health related event⁶. In Malaysia, a report of one person with cholera is considered as an outbreak⁷. Once the presence of a cholera case in an area is confirmed, it becomes unnecessary to confirm other subsequent cases if there is an epidemiological link⁸.

During the past decade, the incidence of cholera in Malaysia had decreased from 10.88 per 100,000 population in 1995 to 1.48 per 100,000 population in 2005⁷.

On 28 Feb 2007 at 16:00, the Melaka Tengah District Health Office (MTDHO) was notified that a patient at Hospital M had a positive rectal swab for *V. cholerae*

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O1 serogroup El Tor biotype Ogawa serotype. Fellows from the Epidemic Intelligence Program (EIP) and health personnel from MTDHO conducted a joint investigation to determine the source, to assess extent of the outbreak and to establish control measures.

Methods

We conducted a descriptive study by reviewing medical records of acute gastroenteritis (AGE) cases at two government clinics, nearby hospital and eight general practitioners from 19 Feb 2007 to 13 Mar 2007.

Active case finding was done by visiting all 350 houses in the village. Anyone with diarrhea and their contacts were interviewed. The standard questionnaire for Food Water Borne Diseases from Ministry of Health was used to collect demographic information, signs and symptoms, and food consumption during the five days preceding their onset of illness.

Rectal swabs were taken from those with diarrhea and their contacts, cultured for enteric pathogens (*V. cholerae*, salmonella, shigella and campylobacter), and tested for antibiotic sensitivities.

An environmental investigation was carried out by inspecting the outbreak site and observing the conditions in the cases' houses and nearby food premises frequented by the cases one week prior to their illness. Surface swabs were taken from cases' kitchen utensils, toilet bowls, floors and sinks, and food handlers' hands. Food, water and ingredients of ice desserts such as "cendol", "cincau", corn, red and black syrup were also sampled.

A case was a person from Village A with acute onset of watery diarrhea more than three times with or without vomiting and/or dehydration from 19 Feb 2007 until 13 Mar 2007, with the presence of *V. cholerae* in a stool culture. Individuals who had similar signs and symptoms with an epidemiological link were considered as cases, and recruited into the study.

Contact was defined as a person who has a familial or social (working or schooling) relationship with a case within five days before onset (incubation period)⁷.

Risk factors were determined by a case-control study. Controls were selected among the household members or neighbors who were healthy (rectal swab was negative for *V. cholerae*). Three controls were collected for each case.

Results

Descriptive Study

Village A was a coastal Malay village about 22 km from Melaka Town, and had 350 houses, with 1,200

residents. Most of population were Malay. Domestic waste was disposed by open dumping, burning or burying. All houses had pour-flush toilets and treated water supply. There was no record of violation water supplies since 2007. Food and water borne diseases was not known to be a health problem in this village, so as AGE from the surveillance data during the same period. No history of cholera cases was reported in this area for the past five years.

There were 18 food premises around the village, and mainly sold ready to eat food, cooked in situ. Food vendors operated small to medium sized stalls that were family owned. Operating hours varied; some were opened the whole day, some only at night, while others opened for breakfast until lunch. One shop sold an ice dessert. The village had night markets every Tuesday, Friday and Sunday, and sold daily usage merchandises and ready to eat food.

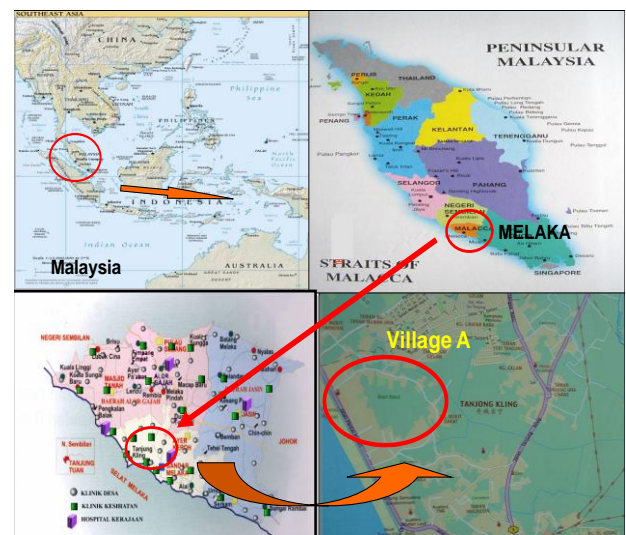


Figure 1. Map of Malaysia with the inset of Village A

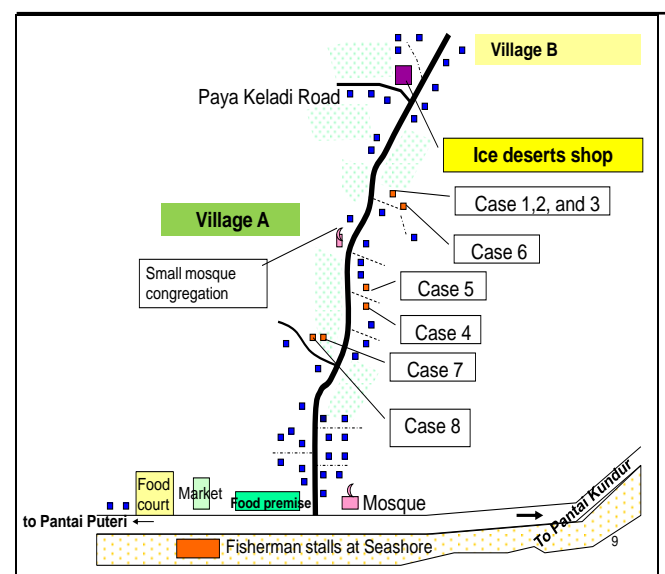


Figure 2. Spot map showing location of cases' houses in relation to food premises in the cholera outbreak

Communal activities in the village included “surau” (mini mosque) congregation every Tuesday and Friday evenings. Food was prepared in a pot-luck manner. The most recent gathering was on 23 Feb 2007, five days prior to the outbreak, and attended by 43 people.

All cases resided near the ice dessert shop and 50 percent of the cases ate ice dessert prior to their illness.

Two were *V. cholerae* positive. All eight symptomatic cases had a very strong epidemiological link⁸.

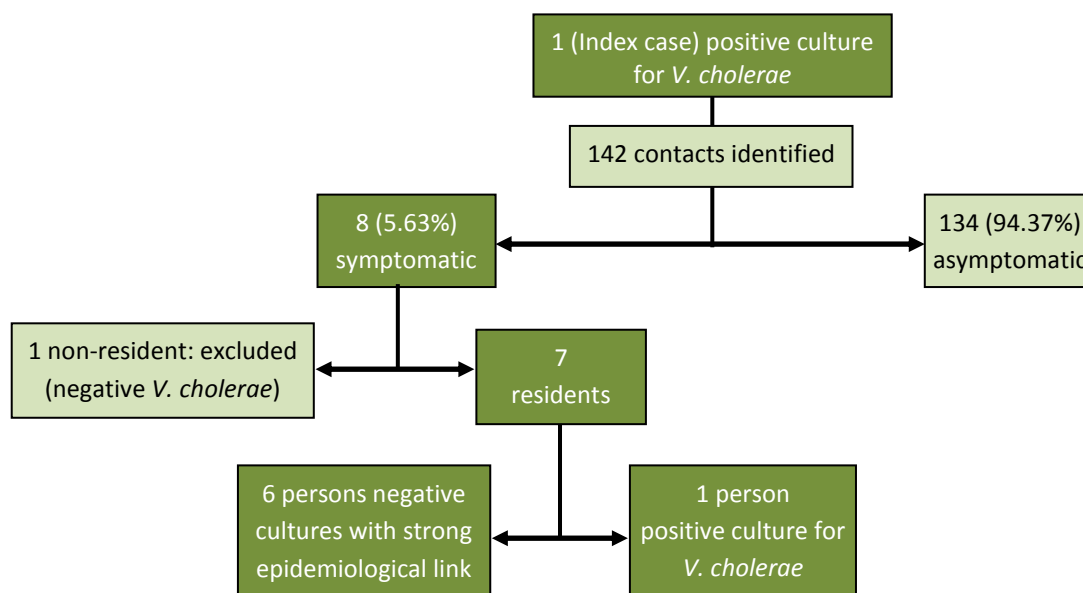


Figure 3. Outcome of cholera outbreak contact tracing in Village A, Melaka.

23 Feb 2007	24 Feb 2007	25 Feb 2007	26 Feb 2007	27 Feb 2007	28 Feb 2007	1 Mar 2007
18:00	03:00	05:00		11:00	08:00	09:30
C2 and C3 consumed ice desserts bought from C5 shop.	C2 developed diarrhea, vomiting and lethargy	C1 (brother of C2) developed diarrhea, vomiting and abdominal discomfort after taking care of C2 including his toilet care. They also shared toiletries. Went to Melaka Hospital. Rectal swab was positive on the 28 Feb 2007.		C5 had diarrhea and abdominal discomfort. C5 had Doxycycline prior to stool swab taken as initially a contact for C4 (son).	C6 (C1's nephew) developed diarrhea, vomiting, lethargy. C6 had chicken with C1 prior to illness. C7 (C4's relative) had diarrhea. C7 visited C4 and had meal prepared by her prior to illness.	C8 (C4's relative) developed diarrhea and abdominal pain. C8 visited C4 and had meal prepared by her prior to his illness.
C4 and C5 also consumed ice desserts.	06:00 C3 (C1 & C2's mother) developed diarrhea, vomiting and lethargy	23:00 C4 developed painless spurious watery diarrhea, vomiting and lethargy. Received metronidazole (flagyl) from private doctor before stool swab taken.				

Figure 4. Diagrammatic representative of the chronology of the outbreak event

Family A: C1, C2, C3, C6 were family members. C2 was the primary case. C1 was the index case. He had poor personal hygiene practices, especially after taking care of C2.

Family B: C4 and C5 were mother and son. C7 and C8 were relatives. C5 sold five to ten packs of ice desserts per evening. He was symptomatic when he sold the ice desserts to C2 and C3, five days prior to the outbreak.

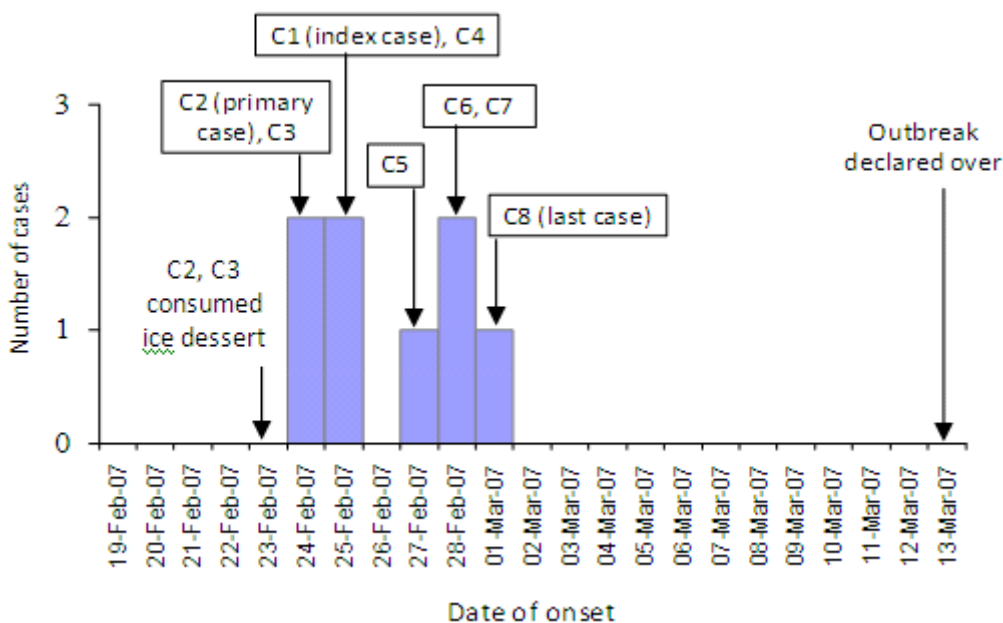


Figure 5. Epidemic curve of cholera outbreak in Village A, Melaka

This was a propagated cholera outbreak with eight cases which was declared over after no new case reported within two incubation period (after 13 Feb 2007). Six were male, and two were female. The youngest was 12 years old, and the oldest was 57 years old. All were Malays.

There were nine family members in the index case's house. The house had one toilet which was clean and separated from the bathroom. The waste disposal dumping area was unsanitary.

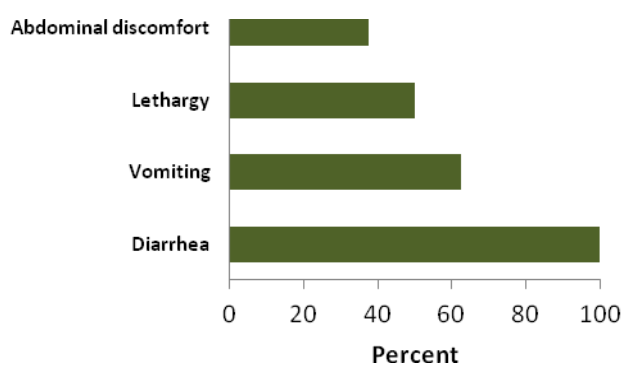


Figure 6. Symptoms of cholera cases in Village A, Melaka

Environmental Study

All houses in the village were made of brick, supplied with treated water, had sanitary toilets, and disposed their solid wastes in the backyard and burned it.



Figure 7. The house, the pour-flush toilet and the unsanitary dumping area of the index case house



(a) Diced ice (b) Ready to eat ice dessert

Figure 8. Pictures showing the preparation of ice desserts

Diced ice was added with “cendol”, “cincau”, corn, milk, and black and red syrup. The ice cubes were made from unboiled water. The red and black syrup was prepared by C4. “Cendol” and “cincau” were

properly packed, labeled and produced abundantly by a factory, bought from a nearby shop. The milk and corn were from cans.



The unsanitary surrounding of the ice dessert shop



Ice dessert machine was not well kept when it was not in use

Storage of left-over ingredients in the refrigerator

Ice made from unboiled water

Figure 9. Pictures showing the unhygienic surroundings of the ice dessert shop and the storage of the desserts

The ice dessert shop was unsanitary. There was no proper bin for waste disposal. Rubbish was dumped beside the concrete slab where the ice dessert was prepared. The slab was dirty. The ice dessert machine was kept unhygienically. Hand washing facility was in a toilet beside the shop.

Laboratory Study

One hundred forty-two rectal swabs were taken from contacts, one was positive for *V. cholerae*.

All cultures were negative for salmonella, shigella and campylobacter.

All 153 surface swabs (45 cooking utensils, 46 hand swabs and 62 surface swabs from tables, bathrooms, toilets, freezers, etc) were negative for *V. cholerae*, shigella and salmonella.

All 96 food samples were negative for *V. cholerae*, shigella and salmonella.

All 58 water samples from the ice dessert shop, food stalls and school canteens were negative for *V. cholerae*, shigella and salmonella.

Case-control Study

Table 1. Percentage of cases with exposure to potential risk factors

Risk factors	Number of cases (n=8)	Percent affected
Ate ice desserts*	4	50.0
Ate food from various places outside the Village A	3	37.5
Ate food from various night markets	3	37.5
Ate food at “surau” or mosque congregation	2	25.0

Given the data in table 1, a hypothesis postulated was that ice dessert was the potential source of the cholera outbreak. This was tested via case-control study, in which 32 respondents were enrolled, eight were cases and 24 were controls (1:3 case and control ratio). Cases and controls were comparable in terms of sex and age group (p-value >0.05). All of them were Malays. Mean age for cases was 31.6±16.1 years, and control was 29.7±15.4 years.

Table 2. Result of case-control study

Food eaten before get sick	Case (n=8)		Control (n=24)		Odds Ratio	95% CI
	Ate	Did not eat	Ate	Did not eat		
Ice desserts*	4	4	3	21	7.0	1.1 – 44.1
Food bought from places outside the Village A	3	5	11	13	0.7	0.1 – 3.7
Food bought from various night markets	3	5	4	20	3.0	0.5 – 18.0
“Surau” or mosque congregation food	2	6	11	13	0.4	0.7 – 2.3

Cases were seven times more likely to consume the ice desserts. Stratification by ingredients could not be done because all cases ate all ingredients (Table 2).

Public Health Actions

Cases were promptly identified and referred to hospital for treatment. Doxycycline was given to all contacts as selective chemoprophylaxis because they were easily identified⁹. The unhygienic ice dessert shop was temporarily closed on 2 Mar 2007 under Communicable Disease Control Act 1988, and reopened on 6 Mar 2007. Enhanced AGE surveillance was done to identify new cases. No new cholera case was reported after 1 Mar 2007. The community was given health education and health promotion on personal hygiene, food safety, preparation of only hot and freshly cooked food hygienically and drinking of boiled water. They were taught to dispose their waste disposal in a hygienic manner. Food hygiene inspections were carried out for food handlers. Individual health education was given during house to house active case detection (ACD) activities. Posters and flyers of cholera were also explained.

Discussion

The Cholera Outbreak

Cholera outbreak in Village A showed clustering of cases among members of two families (eight people). Half had history of eating ice desserts prepared unhygienically by a symptomatic individual. Only two were positive for *V. cholerae* O1 serogroup El Tor biotype Ogawa serotype. One person had classical cholera symptoms, but stool culture was negative because she took metronidazole (flagyl) prior to hospital admission.

V. cholerae is a facultatively anaerobic gram-negative bacillus¹¹. *V. cholerae* may not be isolated from stool samples of cholera patients if the sample collected late in an illness or after microbial therapy is started. Vibriocidal antibody titers peak 10-21 days after infection, and can be used to confirm *V. cholerae* infection. *V. cholerae* infection occur when vibriocidal

antibody titers were greater than or equal to 1:1280¹². In this study, test for vibriocidal antibody titer was not done because of lack of facility for this.

This cholera outbreak was self-limiting and occurred as a small cluster in a family or gathering. Examples of similar outbreaks occurred among husband and wife in Louisiana¹³, 12 cases among nine families in New Orleans¹⁴ and eight patients in Hudson and Union Counties¹². There was no fatal case in this outbreak because of early ACD and prompt treatment.

The spread of infection was from contaminated food and direct person-to-person contact due to poor hygiene. The suspected food was ice desserts prepared by C5 on 23 Feb 2007. There could also be other villagers who consumed the contaminated food, but were asymptomatic. This was because *V. cholerae* El Tor is more likely to cause unapparent or asymptomatic infection as compared to the classical biotype¹¹. El Tor *V. cholerae* infection in both endemic and non-endemic countries showed mild or clinically inapparent infection for every hospitalized patient¹¹. In Louisiana 1986, toxigenic *V. cholerae* O1 was detected in sewer systems of several towns; however, there was no case identified¹⁴. In Maryland in 1991, a cholera outbreak due to *V. cholerae* O1 serogroup El Tor biotype Ogawa serotype was detected involving four people who consumed contaminated coconut milk in a party. Three out of four were symptomatic. One asymptomatic patient had an elevated vibriocidal antibody titer¹⁵.

C1 probably contracted cholera from C2 through direct person-to-person contact (possible to occur¹⁶) because they were sharing the same bed, toilet and fomites¹¹ (like towels and other personal utilities). This is seen in the El Tor biotype; facilitated by its characteristic of longer persistent in the environment, high infectivity, low virulence and greater hardiness¹¹. Spread might have also occurred during C1 taking toilet care of C2 due to poor personal hygiene practice. There was no spread to the other

family members by home cooked food because none of the other five family members in the household had symptoms and their rectal swabs were negative for *V. cholerae*. Moreover, food was prepared by the healthy sister. There was also availability of safe drinking water and proper sewage system in their homes.

Source of the Outbreak

Case-control study results showed that those who consumed ice desserts were seven times more likely to develop symptoms than those who did not (OR=7; 95% CI=1.1-44.1). The individual ice desert ingredients were tested negative for *V. cholerae* because these were not the ingredients used during the outbreak. A possible source of contamination was from the poor hygienic practice of the handler (C5) with unsanitary environmental condition of the shop. He could be an asymptomatic carrier whose status could persist for several months³, and later became symptomatic. His rectal swab was *V. cholerae* negative because he took doxycycline prior to his rectal swab taken.

All environmental samples were negative for *V. cholerae*. Sea water samples to prove cholera endemicity was also negative. Those samples were tested by standard culture and sensitivity procedure which can only detect viable organisms. There is a laboratory procedure using Polymerase Chain Reaction (PCR) technique which can detect cholera DNA from nonviable organism¹⁶. However, such test was not available in Malaysia.

Public Health Actions and Follow Up

The early ACD with enhanced surveillance managed to identify all suspected cases and referred to hospital for early proper management. Health education and promotion resulted change in community behavior; "surau" or mosque congregation did not prepare food as they usually did, waste disposal was disposed of in hygienic manner. The backyards of houses were cleaned. Inspection of food premises was done as scheduled. Their rating was satisfactory (>75%). Doxycycline prophylaxes, which were done selectively to all contacts of symptomatic cases as selective chemoprophylaxis, might be useful for household members who shared food and shelter with cholera patient⁹.

Limitations

The sample size was small, thus, limiting analysis to the primary hypothesis. Recall bias was inevitable. However, respondents were given ample time to recall their dietary intakes and allowed help from other family members as most of them ate home-cooked

food. Food samples collected for microbiological culture were not the actual food items eaten by cases. There was a limited capability in swab culture and sensitivity to detect cholera antigen as compared to vibriocidal antibody titer test and PCR technique, which can detect DNA from nonviable organism¹⁷. *V. cholerae* may not be present if the swab is taken late in their illness. Swab culture and sensitivity was subjected to stringent processes. Contamination might affect the result.

In conclusion, the cholera outbreak caused by *V. cholerae* serogroup O1 biotype El Tor serotype Ogawa in Village A, Melaka occurred among members of two families who were linked epidemiologically to a food handler who prepared ice desserts unhygienically. There were no deaths in this outbreak.

Recommendations

The environmental health team should continuously promote hygienic and proper waste disposal methods to the community. Regular inspection of food premises should be carried out. Unhygienic premises should be closed. It will be useful to have vibriocidal antibody titer testing to complement the standard culture and sensitivity procedure so that confirmation of cases would be easier if stool or rectal swab negative for *V. cholerae*. It will also be helpful to have PCR technique to test for *V. cholerae* DNA in a non-viable condition to identify the vehicle. Good communication and cooperation among staff of hospital, health personnel and community members are essential for an effective control and prevention of the outbreak.

Suggested Citation

Ujang N, Kamaluddin A, Kamaludin F, Syed Sheikh SH, CM Din SNA, Ariffin R, Suleiman A. Cholera outbreak in Village A, Tanjung Keling, Melaka, 2007. OSIR. 2011 Apr;4(1):13-20.
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