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## Resurgence of cholera in Hong Kong

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### SUMMARY

Cholera is one of the three diseases subject to the International Health Regulations. After a period of over 30 years, the seventh pandemic of cholera, which started in South East Asia in 1961, still shows no sign of a decline. On the contrary, it has increased its severity and invaded many other countries in Africa and Latin America. In the last two years, there has been a recrudescence of the disease in South East Asia and Western Pacific Regions. The discovery of a new strain of *Vibrio cholerae* 0139 in these regions is causing concern in view of its potential to cause major epidemics and higher mortality. Hong Kong had two intensive outbreaks of cholera in the last two years. The cause of these outbreaks was not clear, but adverse environmental conditions and increasing pollution of coastal waters have been implicated. The spread of cholera knows no geographical boundaries. There is a need for intensified efforts among health authorities in the affected areas to prevent the international spread of the disease.

### INTRODUCTION

The seventh pandemic of cholera began in South East Asia in 1961. It was caused by the El Tor biotype of *V. cholerae* 01. Before 1961 cholera El Tor was endemic in the island of Sulawesi (Celebes). Since then, it had spread from its endemic focus to many countries [1].

By 1971, most European countries and northern part of Africa were affected. By the end of 1980, the disease had reached UK in the West, Russia and Korea in the North, Australia in the South and American countries in the East. In 1991, it spread further to Peru in Latin America and caused a massive outbreak in South and Central America.

In 1993, cholera was officially reported to the World Health Organization (WHO) from 78 countries, 10 more than in 1992 and 19 more than in 1991. Most developing countries in Asia, Africa and Latin

America have been affected [2]. During that year, a considerable increase in the reported number of cholera cases was seen in the Western Pacific Region. Eleven countries in the Region reported a total of 24707 cases, which was more than a threefold increase of 7249 cases in 1992. Most of the cases were reported from China (47·4%), 22·3% from the Lao People's Democratic Republic and 13·6% from Vietnam. The increase in the number of reported cases in China in 1993 was mainly due to a major epidemic in that country. The cases were distributed in 12 provinces, autonomous regions and municipalities; 77% of the cases were from the Xinjiang Autonomous Region and 18·8% from the Guangdong Province [3]. Improved bacterial surveillance and better compliance with the International Health Regulations on reporting cholera cases to WHO also accounted for part of the increase.

By the end of 1994, the WHO Western Pacific

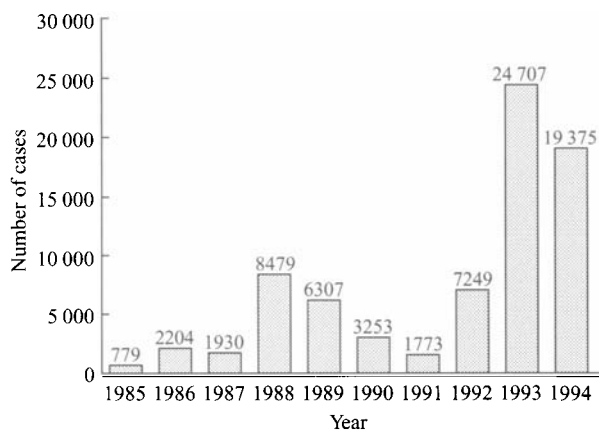


Fig. 1. Cholera cases in the Western Pacific Region 1985–94.

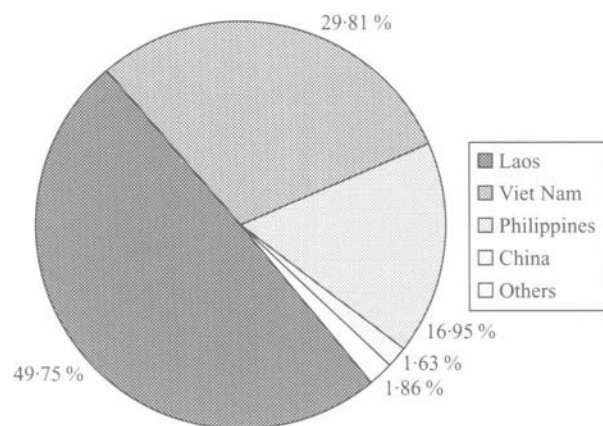


Fig. 2. Distribution of cholera cases in the Western Pacific Region in 1994.

Regional Office recorded a total of 19375 cases in its surveillance report [4]. The majority of the cases were from Laos (49.8%), Vietnam (29.8%) and Philippines (17.0%). Figure 1 shows the total cases in the region from 1985–94 and Figure 2 shows the distribution of cholera cases of four countries in the Western Pacific Region in 1994.

Since the appearance of cholera in South East Asia in 1961, there is no sign of a decline of the disease. On the contrary, it often increases its severity and invades other countries, particularly when conditions of spread became favourable, such as flooding, poor sanitation, inadequate safe water supply, increased overcrowding and declining socio-economic conditions.

Hong Kong has been having cholera cases periodically over the past 33 years. In the early parts of the 1960s, it was in the form of outbreaks with cases reported among people living in overcrowded old tenement buildings, resettlement estates, squatter

huts, villages and boat dwellers. Since 1970s, cases of cholera were sporadically reported among tourists and local residents who had visited cholera infected areas and developed symptoms after returning to Hong Kong [5]. In 1970s and 1980s, with the exception of 1986 and 1989, the number of cases reported was less than ten per year. But in the last two years in the 1990s, there appeared to be a resurgence of the disease with over 30 cases reported each year (Fig. 3).

### Epidemiological features of cholera in Hong Kong, 1961–94

The clinical presentation of El Tor cholera differed from that of classical cholera in that the disease commonly appears as a mild diarrhoea of short duration. A number of cholera cases in the past outbreaks in Hong Kong had only mild diarrhoea and the diagnosis of cholera was only confirmed by routine bacteriological examination of stool specimens from patients [6].

In the 1960s, cholera cases were commonly seen among the older and younger population of low socio-economic status living in overcrowded environment with poor sanitation. But since the 1980s, cases are usually seen among the adult age group and very few are reported from children. Of the 30 cases in 1993, 2 were children and among the 56 cases in 1994, only 3 were children.

#### Pattern of spread

In Hong Kong majority of the cholera cases appeared sporadically and in an isolated fashion. The mode of transmission among these cases was most likely food borne or due to person-to-person spread specially among members of the same family. Outbreaks pointing to a common source or a common vehicle of infection have also been reported. On one occasion in 1964, the source of infection was traced to contaminated water supply in a restaurant [7]. On another occasion in 1986, a food factory supplying lunch boxes was responsible [8]. In 1994, seafood kept in polluted sea water appeared to be responsible for a total of 12 cases from the southern part of Hong Kong island.

#### The role of water

The classical examples of water-borne cholera epidemics are well illustrated in the John Snow's Broad

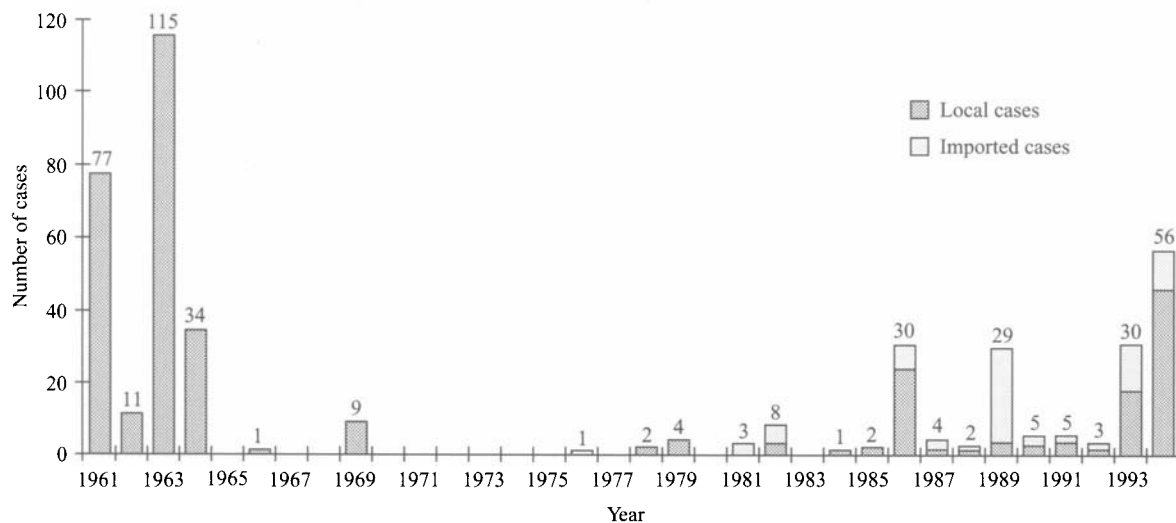


Fig. 3. Frequency distribution of cholera cases in Hong Kong 1961–94.

Street Pump epidemic in London in 1854 and the Hamburg outbreak in 1892. In Hong Kong, the Temple Street well outbreak in 1964 was another classical example. In 1963 and 1964, Hong Kong experienced the worst water shortage as the annual rainfall was less than 42% of the normal annual total. Many food premises turned to unauthorized sources of water supply such as wells and streams to meet their needs. The owner of a restaurant at Temple Street illegally connected the water supply system from a well to a water storage tank on the roof. From there illegal water piping was connected to a mains water supply system. As a result, the whole mains water supply to the kitchens was contaminated. Before the outbreak, a food handler who was later found to be a carrier of the disease, had used all the water closets in the restaurant. Due to building defects in the restaurant premises, the water from a water closet leaked into the well adjacent to it. As a result a short but intense outbreak of cholera occurred resulting in a total of 32 people infected [7].

#### *The role of foods*

There were two interesting observations on the role of foods in the transmission of cholera in Hong Kong [9]. One observation was concerned with contamination of foods by carriers, and the other was contamination of food by polluted water. On the former, there had been several occasions in which carriers of cholera vibrios were found working as food-handlers in food establishments. In one incident, 32% of the staff (over 100) in a restaurant in northeast Kowloon in 1963 were found carriers and 17 persons contracted the

infection as a result of having eaten food at the restaurant or purchased food from the restaurant and eaten outside. In another incident in 1964, 17 persons were found to have contracted infection from a restaurant in which 18 out of the 46 employees were found to be carriers [10].

Contamination of food by polluted water can occur either by the use of such water in the preparation of foods or drinks or when polluted water is used for washing of food, kitchen or eating utensils. The risk of transmission is likely to be increased when polluted water is used directly in the preparation of foods or drinks which are to be served cold without further heating. In Hong Kong, cold drinks or jelly-like substances are popular food items in summer. The danger of infection is particularly great when these foods or drinks are prepared by unlicensed hawkers under very unhygienic conditions.

#### *The role of fish and shellfish*

The danger of fish and shellfish in transmitting cholera has been a subject of special concern in Hong Kong in view of the presence of pollution of coastal waters by sewage discharging from land and the practice of consuming these foods in an 'inadequately cooked' condition. In 1963, one spotted crab sampled from the Aberdeen district on the southern part of the Hong Kong island was found to contain *V. cholerae* [10]. Previous studies on outbreaks of cholera in the Western Pacific Region have shown that the disease was associated with consumption of raw clams, salt-fish, sardines, and other fish from the lagoon, [11] and cooked squid [12].

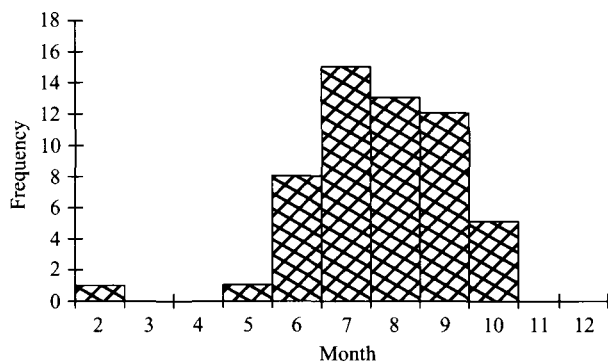


Fig. 4. Frequency distribution of cholera by month in 1994, Hong Kong.

As with most other major cities in the world, Hong Kong's sewerage and sewage treatment systems have grown exponentially and in many areas have not kept pace with the rapid growth of population and development in general. Tonnes of sewage and industrial wastewater are generated each day in Hong Kong and discharged into the sea so it is no surprise that most of the territory's waters are heavily polluted [13]. Only a small portion of wastewaters are fully treated, some is partially screened before being discharged offshore through marine outfalls, but a large proportion enters the sea through storm water drains without any form of treatment [14].

During the cholera outbreaks in July 1994, *V. cholerae* were isolated from the water in a fish tank kept in a restaurant premises in Aberdeen. The organisms were biotype El Tor serotype Inaba. Because of the popularity of eating seafood in Hong Kong, it is the customary practice for restaurant operators to keep fish and shellfish alive in the water tanks in restaurants. The water in the fish tanks is transported by commercially operated 'water vehicles'. The operators of these 'water vehicles' usually draw water from the polluted harbour or typhoon shelters, the latter are protected anchorage areas to provide shelters for fishing junks and other small vessels against strong monsoon winds known as typhoons. In the July 1994 outbreak in Hong Kong, 12 cholera cases were found to have consumed seafood in the Aberdeen district either at restaurants or from hawkers selling seafood on boats in the typhoon shelter or at home. All the 12 cases were of serotype Inaba [15].

At around the same time, the neighbouring territory of the Macau health authority reported that samples of sea water taken from two fish-tank barges used for the transportation of fish into Macau contained *V.*

*cholerae*. It was also reported in August in the same year that *V. cholerae* had been found in a fish-tank of a seafood restaurant in Macau.

There was also a report in the local media in July that the Taiwan health authority had isolated *V. cholerae* from a consignment of fish being imported into Taiwan. In both places the consignment of fish was said to have come from Hong Kong.

There is a considerable amount of transportation by air and sea of high price seafood between the South-East Asian countries and Hong Kong has been serving as a transit centre for the re-exporting of such seafood. It is therefore difficult to determine the origin of seafood and the source of sea water from which positive samples of *V. cholerae* have been found. However, in view of the high endemicity of cholera in this Region, such international transportation of fish and shellfish and the water that goes along with it would create public health problems as they may carry the infection to other countries.

#### Emergence of *V. cholerae* 0139

In early 1993, outbreaks of a diarrheal disease clinically resembling cholera were reported in India and Bangladesh. The organism responsible for these epidemics was not *V. cholerae* 01. It was subsequently identified as a new strain designated as serogroup 0139 [16]. The new strain has the ability to produce a toxin which is indistinguishable from the toxin produced by *V. cholerae* 01. In mid-1993, China, Malaysia and Thailand reported the presence of cholera cases due to serogroup 0139. In China alone, 201 cases of cholera 0139 were reported in that year [3]. In September 1993, the first imported case of *V. cholerae* 0139 was reported in Hong Kong. In 1994, two more imported cases of 0139 were reported, one each respectively from China and Thailand.

Although the epidemiological features of the disease due to the new strain basically do not differ from those caused by *V. cholerae* 01, its rapid spread, potential to cause major epidemics and the much higher mortality rate do give rise to concern.

#### Resurgence of cholera in Hong Kong

Hong Kong has been free from outbreaks of cholera in the 1970s and the early part of the 1980s, and with the exception of 1986 and 1989, cases were reported only sporadically during this period. This quiescent

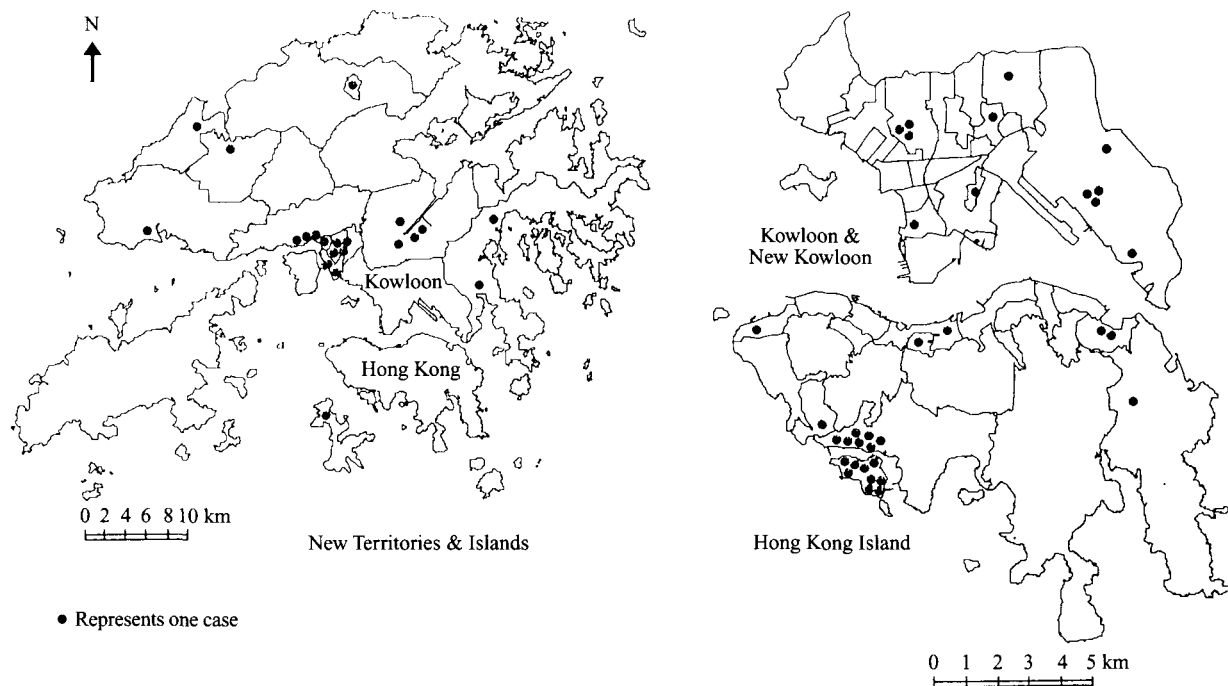


Fig. 5. Distribution of cholera cases in Hong Kong, 1994.

period was continued into 1992. In 1992, only three cases of cholera El Tor serogroup 01 were reported in Hong Kong. Two were imported cases from China and one was a local case. However, after 1992, the situation has changed. In 1993, 30 cases were reported including 29 cases caused by serogroup 01 and 1 imported case caused by the new serogroup 0139. Of the 30 cases, 13 were imported and 17 were local. Among the imported cases, 5 were from China including 1 case caused by the serogroup 0139, 2 each from India and Singapore, 3 from Thailand and 1 from Indonesia. [17]

In 1994, beginning in June and for the next 3 months, there was a short but intense outbreak of cholera. Within a period of 4 months a total of 50 cases were reported (Fig. 4). 15 of these cases were reported from the southern part of Hong Kong island. Of these, 12 cases had history of having taken seafood from the restaurants, food boats or at home in southern district where *V. cholerae* had been isolated from the fish tank in a seafood restaurant. The southern part of Hong Kong island has a typhoon shelter which is a popular source of water supply to fish tanks in this area.

In all a total of 56 cases were reported in Hong Kong in 1994. They consisted of 26 males and 30 females. About half of the cases were in the age group 30–50 years, 29% were under 30 and 21% were aged 60 and over. Thirty-five of the 56 cases were biotype

El Tor and serotype Ogawa, 19 cases were of serotype Inaba and the remaining 2 cases were of 0139 strain. About one third of the cases were in the southern district of Hong Kong Island which occupy about 4.4% of the total population. Another 18% of the cases were from the Tsuen Wan and Kwai Chung districts to the North-Western part of Kowloon. The others were from various districts in the territory. All these were isolated cases (Fig. 5). It is of interest to note that 11 cases had been to other places outside Hong Kong before onset of illness. Five of them had visited areas in the Pearl River Delta in China.

## DISCUSSION

It is not clear why a short but intense outbreak of cholera occurred in Hong Kong in summer 1994. There are several factors which render Hong Kong particularly vulnerable to the spread of communicable diseases into the territory [18]. First, for many years Hong Kong has been facing the problems of influx of refugees and immigrants. They brought communicable diseases endemic in their countries of origin into the territory. In the past, outbreaks of cholera had occurred in camps of Vietnamese boat people but there was no evidence to suggest that the present outbreak was caused by refugees or immigrants. Secondly, Hong Kong has a close geographical relationships with China and it imports considerable

amounts of food, live stock and water from the neighbouring districts of Guangdong. Any adverse environmental conditions in these districts may have an impact on the level of health of the people in Hong Kong. In the month of June of 1994, there had been reports of severe flooding in southern part of China. However, it was difficult to establish a direct link between the outbreak of cholera in Hong Kong and the deterioration in environmental sanitation in Southern China. This was partly because no major outbreaks of cholera had been reported in flood affected areas in China, and furthermore, no cholera cases had been reported in the New Territories adjacent to the Chinese border. Thirdly, Hong Kong is at a cross-road of international travel. The large volume of tourists entering Hong Kong as well as the considerable number of local residents travelling to endemic countries in South-East Asia greatly increase the risk of introduction of communicable diseases. In this outbreak, the majority of the cases had no history of travel and the infection was likely to have been contracted in Hong Kong. Fourthly, there is increasing pollution of sea water in typhoon shelters. The practice of using heavily polluted water in fish tanks is causing concern, although in the present outbreak, it had not been possible to trace the source of *V. cholerae* in the fish tank and to establish the link between the consumption of seafood and the reported cases in the Southern district.

Apart from the recent 2 years, Hong Kong has achieved considerable success in the control of cholera. This is due largely to public health efforts, an effective surveillance system, a high standard of medical care and improved living standards and hygiene. However, with the upsurge of cholera in Asia, including a newly identified strain and increasing pollution of coastal waters, there are bound to be new challenges in the future.

Future strategies of control should be built upon the principles of protecting the environment, ensuring safe and adequate water supply, maintaining a high standard of environmental hygiene and sanitation and adhering to the practice of good personal and food hygiene.

Following the outbreak of cholera in the summer, legislation was introduced in Hong Kong setting the bacteriological standard of water in fish-tanks to be not more than 610 *Escherichia coli* in 100 ml of seawater. This standard follows the guideline of the Hong Kong Government Environmental Protection Department for seawater for swimming and other

recreational purposes in public beaches [19]. While this measure may minimize the risk of transmission, in the long term high priority should be given in developing a sewage treatment and disposal programme in Hong Kong to reduce the level of pollution of the coastal waters.

The spread of communicable diseases knows no geographical boundaries. There should be joint actions among health authorities in China and Hong Kong in the surveillance of major communicable diseases affecting these areas. The tri-partite surveillance programme initiated by the WHO Regional Office for the Western Pacific and involving China, Hong Kong and Macau is an excellent example of joint efforts to prevent the international spread of communicable diseases.

Community participation and health education play a significant role in the prevention and control of communicable diseases. Education and publicity not only promotes better understanding and awareness of the diseases but also encourages the adoption of appropriate measures in disease prevention. The provision of health information and health advice to potential travellers going to countries endemic with communicable diseases is of particularly value.

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