

# Review of Cholera in Malaysia (1900—1970)

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THE HISTORY of cholera in Malaysia, like other countries in the region, dates back to antiquity but the earliest known records of the disease appear in the 1828-30 records of the Durian Daun Hospital in Malacca (Sandosham, 1964), and in the writings of Mrs. Innes (1885) who lived in a remote kampong at Langat, Selangor. Another outbreak in a crowded Chinese junk on the high seas is depicted in the writings of Sir Hugh Clifford (1913) who based his story on an actual occurrence. This was the arrival at Port Swettenham (now Port Klang) in 1896 of Chinese junks which had sailed down from the China coast and had been refused admission to the port of Deli, Sumatra, due to cholera amongst the crew. With a view to convince the Klang authorities that the junks were no longer carriers of cholera cases, the survivors on board the junks, before reaching Port Swettenham, threw overboard their recent dead, the comatose and many in the early stages of the disease. At this stage, it would appear the wind dropped and the current carried the junks into port surrounded by bobbing shark-jostled corpses as if the dead were following silently to accuse the living. Even so, when the seemingly healthy survivors were quarantined on board for six days, the records show that 57 further cases developed and out of these, 38 died.

Since its establishment in 1900, the Institute for Medical Research, Kuala Lumpur, has played an ever-increasing important role in the investigation of tropical diseases and there has been an efficient linkage with the health authorities resulting in ready facilities for cholera investigation. A comprehensive review of cholera in Malaysia up to 1950 by Green (1951) appears in the IMR Studies No. 25. From time to time reports on cholera have appeared in the annual reports of the Institute (1915, 1920, 1925, 1928, 1938, 1961, 1963, 1964, 1965, 1968, 1969 & 1970). Since 1928, the Institute has been responsible for the production of cholera vaccine to meet the country's needs.

Malaysia, like other countries, has had its fair share of the pandemics, which originated from the Ganges delta, the home of cholera. Prior to 1817, there were no records of its spread to the rest of the world. Cholera first appeared in Malaysia in May 1819 during the first pandemic. The original site of entry was at Malacca and it recurred in December 1819, continuing to February 1820. In October 1819, the epidemic cholera also appeared in Penang and the disease is said to have been carried overland through Burma and Thailand. The disease in Penang spread rapidly and according to Ward and Grant (1830) the mortality was consi-

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derable. The Indians and the Malays were the greatest sufferers. There were between 40 to 50 deaths daily. The Chinese were not spared either.

In 1895, according to Rodger (1896), just prior to the installation of the Kuala Lumpur water supply, 126 inmates of the prison in Kuala Lumpur contracted cholera and, of these, 68 died. There was a similar outbreak in the Taiping Gaol in 1911.

The earliest record of a cholera epidemic in Singapore dates back to 1841-1842, i.e. just prior to the third pandemic of 1846-1862. Subsequent epidemics occurred in 1851, 1862, 1873-1874, 1895-1896, 1900-1903, 1910-1914 (average 170 cases yearly) and 1924-1928 (average 15 cases a

year). From 1910 to 1928, a total of 1,531 cholera cases were quarantined at Singapore from ships calling there. From 1929 to 1941, there were no cases of cholera in Singapore town or at the quarantine station. In August 1943, a Japanese ship arrived in Singapore with 50 cases of a cholera-like disease on board, and was quarantined at the Seletar base. There were eight deaths. While steaming in Singapore waters, the ship jettisoned vegetables which were recovered and consumed by Malay fishermen. Five days later, there were cases of a similar cholera-like disease amongst the fishermen and their families. Cholera vibrios recovered from the dead Malays and the Japanese were identical in bacteriological properties. Similar strains isolated

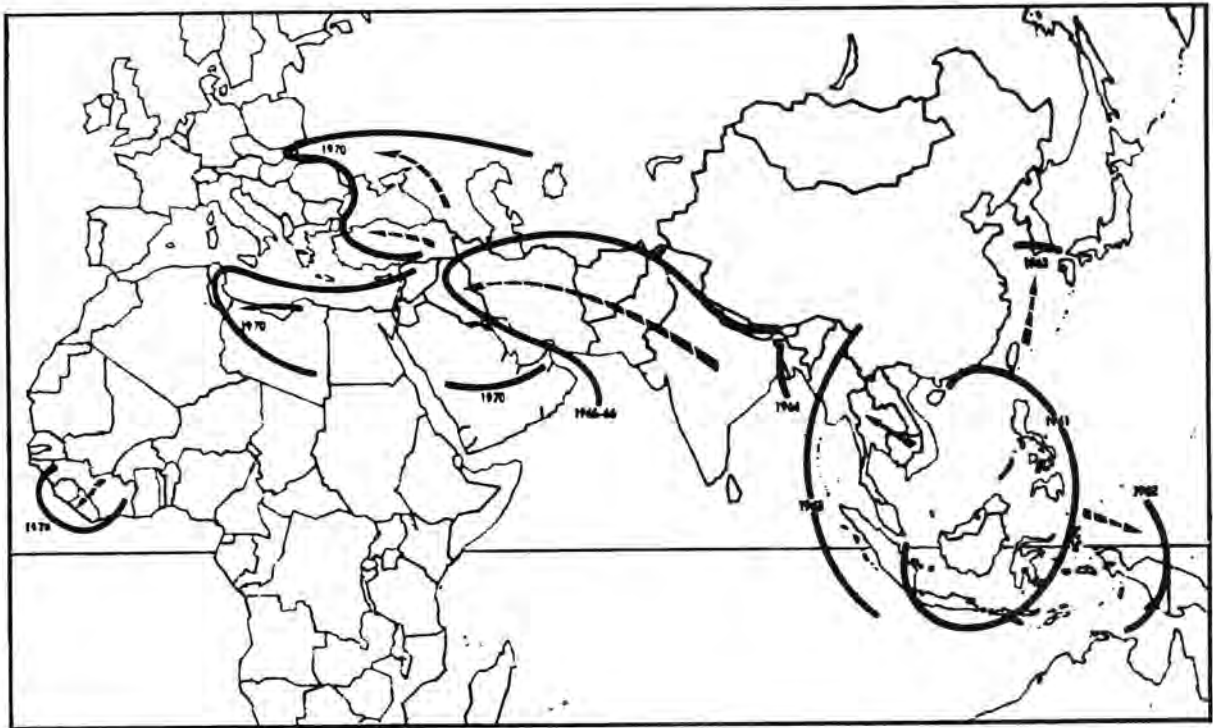
TABLE I  
Cholera within the states of Malaysia from 1900 to 1970

Period	Cases	Deaths	Death rate per 100 cases	States invaded and number of cases
1902 to 1907	133	97	73	Selangor 41; Pahang 39; Perak 53.
1902* (June)	?	>1500	?	Sarawak
1910 to 1915	1685	1114	60	Selangor 237; Pahang 280; Perak 1121; N. Sembilan 1; Trengganu 46.
1918 to 1920	186	149	80	Selangor 1; Pahang 1; Perak 184.
1924 to 1927	132	85	64	Selangor 13; Perak 119.
1945 (June)	287	216	75	Perlis
1946 (June)	221	182	82	Kelantan & Trengganu
1961 (July)	301	70	23	Sarawak
	7	0	0	Sabah
1962 Nov./Dec.	16	3	18	Sarawak
1962 (Jan.-March)	35	11	30	Sabah
1963 (May)	205	14	7	Malacca — the first known <i>E/ Tor</i> cholera on the mainland of Malaya; Selangor; Perak; Kedah; Perlis; Johore; Negri Sembilan.
1963 Jan. & July	98	7	7	Sarawak
1964 (May/June)	513	33	10	Kedah; Perlis; Kelantan; Trengganu; Pahang; Malacca; Perak & Johore.
1964 May	198	33	16	Sarawak
1964 June	5	1	20	Sabah
1965 November	1	0	0	Selangor
1968 May/June/July	15	0	0	Kedah; Penang & P.W., Perak; Selangor; Johore.
	15	1	7	Sarawak
1969 (May)	70	5	7	Penang & P.W., Kelantan; Trengganu.
1970 May/June	27	1	3	Penang & P.W.

\* Previous to the 1902 outbreak there was an epidemic in 1888, but apparently this was not severe.

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FIG. 1: EXTENSION OF CHOLERA 1961 — 70



Taken from "Public Health Papers No. 40 — Principles and Practice of Cholera Control", World Health Organisation, Geneva.

by De Moor in Macassar were identified by Van Loghem as haemolytic *Vibrio cholerae* *El Tor* (De Moor 1939 and Van Loghem 1939).

Cholera in Malaysia during 1900-1970 is summarised in Table I. From 1900 to 1927, a total of 2,644 cases, with 1,833 deaths, were recorded. Cholera invaded the states of Selangor, Perak and Pahang during 1902-1907, 1910-1915, 1918-1920 and 1924-1927. In certain years, notably 1910, 1911, 1914, 1918 and 1927, the incidence assumed epidemic proportions. Negri Sembilan, possibly for reasons of its geographical situation, appeared to have remained relatively free from cholera.

In 1945, there was an epidemic of cholera in the northern state of Perlis. The mortality was rather high, 216 deaths out of the 287 cases. In the following year in 1946, there was an outbreak in the states of Kelantan and Trengganu. Again the mortality was high. There were 182 deaths out of 221 cases.

Up to 1946, all the cholera outbreaks were entirely due to the classical *Vibrio cholerae*. How-

ever *Vibrio cholerae* biotype *El Tor* had been occasionally isolated from sporadic cases of diarrhoea in Malaysia. From 1947 to 1960, Malaysia was free from cholera. The next outbreak was in 1961 (East Malaysia — Sabah and Sarawak) and the subsequent outbreaks in 1963 (West Malaysia and Sarawak), 1964 (West Malaysia, Sabah and Sarawak), 1965 (West Malaysia and Sarawak), 1968 (West Malaysia) 1969 (West Malaysia) and 1970 (West Malaysia) were all due to *Vibrio cholerae* biotype *El Tor*. This spread to Malaysia was a part of the path of the extension of the current *El Tor* cholera pandemic which started in Sulawesi in 1961. The subsequent extension of pandemic (1961-1970) is shown in Fig. 1 by Barua and Cvjetanovic (1970). It shows the spread of cholera since 1961 to at least 40 territories. Before 1961, cholera was reported annually from only 3-6 territories. Some of these countries, including Malaysia, have had recurrences after remaining free of cholera for some years, and in several countries the *El Tor* cholera has truly become endemic.

## El Tor Cholera in Malaysia (1961-1970)

### Sarawak Epidemic (1961-1965)

This outbreak in 1961 is well documented in a Government report published in 1963. In July 1961, a number of deaths were reported in a kampong across the river opposite Kuching town. On investigation, several other cases of what appeared to be severe dysentery were found and one of the patients was persuaded to enter hospital for laboratory investigations. The laboratory investigation confirmed cholera. By the fourth day, the number of cases had risen to 62 and from thence on the epidemic spread rapidly as is indicated by the number of cases and deaths shown below:

Date	Number of total cases to-date	Number of total deaths to-date
15th July (4th day)	62	—
18th July (7th day)	117	22
22nd July (11th day)	195	34
29th July (18th day)	248	49
12th August (32nd day)	252	49
30th September (81st day)	293	69
19th October (100th day)	301	70

It is interesting to record that:

- (i) of the 301 cases, 113 were confirmed positive bacteriologically for cholera, and
- (ii) the laboratory investigations also confirmed that during the cholera outbreak in Sarawak, there was also a concurrent outbreak of bacillary and amoebic dysentery. From July to October 1971, the laboratory reported the following isolations:

<i>V. cholerae</i> biotype <i>El Tor</i>	113
<i>E. histolytica</i>	46
<i>Sb. flexneri</i>	82
<i>Sb. sonnei</i>	17

The epidemic in Sarawak continued through to 1965 as shown in Table II.

### Sabah Epidemic (1961-1964)

In 1961, there were 7 cases of cholera, in 1962 there were 35 cases with 11 deaths and in 1964 there were 5 cases with 1 death.

TABLE II

#### El Tor Cholera Epidemic in Sarawak (1961-1970)

Year	Number of cases	Number of deaths
1961	301	70
1962	16	3
1963	98	7
1964	198	33
1965	15	1
1966-70	—	—

#### El Tor Cholera Epidemic in Sabah (1961-1965)

1961	7	0
1962	35	11
1963	—	—
1964	5	1
1965-70	—	—

### Cholera Epidemic in West Malaysia (1963-1970)

#### Malacca Outbreak (1963)

It is speculated that the infection was conveyed to Malacca by the sea routes from West New Guinea through Java and Sumatra. The occurrence of cholera was recognised in Sumatra in 1962 and it is conceivable that the organism may have crossed the narrow Straits of Malacca by the many small sailing crafts that ply daily between Malacca and the Sumatra coast without medical inspection of the crew.

The epidemic in Malacca appeared in May, towards the close of a severe drought. Due to the failure of the northeast monsoon (which is normally expected between October and February) the wells dried up (some for the first time in living memory) and the level of the Malacca River, which is the main source of Malacca's water supply, fell to an unprecedented low level. Under the circumstances of extreme drought, the influence of the high tides which is normally restricted to the lower reaches of the Malacca River extended far upstream and the brackish sea water was carried upstream beyond the uptake point of Malacca's water supply. Furthermore, the brackish river was also being heavily polluted by:

- (1) the effluents of the septic tanks of the General Hospital, which discharge into the river,
- (2) the washing of sanitary buckets in the river, and

- (3) the sewage from the numerous riverside kampong latrines.

Thus, it would appear that contaminated water was passing into the water filtration plant during and also weeks preceding the epidemic. Further during this critical period, there were also indications that chlorination had failed for several hours during the critical period in the early stages of the epidemic.

During the early stages of the epidemic, the cases were distributed mainly within the Malacca municipal area and within the Bukit Sebukor water supply. Later foci of infection appeared in widely scattered parts of the state, indicating that the later peripheral spread was mainly due to the movements of cases or carriers who also carried the disease into the states of Johore, Negri Sembilan and Perak. The outbreak continued into 1964 and spread to Selangor, Kedah, Perlis, Kelantan, Trengganu and Pahang. Meanwhile the outbreak, which started in Sabah and Sarawak in 1961, continued. Thus by 1964, the Cholera *El Tor* epidemic was truly pan-Malaysian.

In West Malaysia, the *El Tor* epidemic has continued to smoulder with sporadic cases in Perlis, Kedah, Penang, Perak, Selangor and Johore in 1968, and outbreaks in Kelantan in 1969 and in Penang and Province Wellesley in 1970.

## The Mode of Entry of Cholera in Malaysia

The infection in 1910 and 1911 was believed to have been introduced into Selangor and Perak from India, and in Pahang and Trengganu from Siam. On occasions, the origin of the disease has been obscure and has tentatively been ascribed to carriers and illegal immigrants. In 1907, an outbreak involving 12 cases with 11 deaths at Kuala Selangor was ascribed to clothing of a labourer newly arrived from India. Watson (1927) reported that in 1910, some cases of cholera had arisen from clothing "inherited" from those who had recently died from cholera.

## Entry into Malacca during the 1963 outbreak

Throughout 1961, sporadic infections with the *Vibrio cholerae* biotype *El Tor* was reported from the Celebes. The spread of the epidemic from 1961 to 1963 from the Celebes has been summarised in the report on the "Outbreak of Cholera in Malacca 1963" (1964) and this is shown in Table III.

According to Felsenfeld (1963), the spread to

TABLE III

### *El Tor* Cholera in South-East Asia & Western Pacific May 1961 — May 1963

Country	Cases	Deaths	Percentage Mortality	Period	Origin
Celebes	109	29	27	1961	Primary centre
Indonesia	4017	897	22	May 1961 Feb. 1963	Secondary centre Jakarta
Sarawak	582	79	17	July 1961	Macassar
Macau	13	6	46	August 1961	Kwangtung ?
Hongkong	76	15	20	August 1961	Macau ?
Philippines	18556	2323	13	Sept. 1961 April 1962	Macau ? Secondary centre Manila
West New Guinea	1428	498	35	Sept. 1962 March 1963	?
Malacca*	205(128)	14(9)	7	May 1963	?

\* (Figures in brackets are bacteriologically confirmed cases)

**TABLE IV**

**Distribution of cholera (1961-1970) by ethnic group**

Year of epidemic	Ethnic group			
	Malays	Chinese	Indians	Others
1961 — Sarawak	160	16	—	67 (Dyaks)
1964 — Trengganu	181	4	—	—
Kelantan	36	—	—	—
Pahang	36	2	—	—
1969 — Kelantan	65	1	2	—
1970 — Penang & Province Wellesley	—	27	1	—

Sarawak seems to have come directly from the endemic centre in Macassar and from the Philippines, the disease moved southwards through the islands and was introduced into North Borneo by a visitor from Jolo Island. The exact mode of entry in Malacca is not known, but the presumption is that the *El Tor* vibrio was brought in by sea from some undisclosed source. The seaways between New Guinea, Java and Sumatra are open, and there is evidence of trade between Malacca and Sumatra which is only 30 miles away.

**Epidemiology**

Cholera commonly occurs after the dry spell in May, June and July when the rainfall is lowest. The annual average rainfall in West Malaysia is 94.96 inches on the west coast and 118 inches on the east coast.

Cholera is a water-borne disease which flourishes in areas of poor water supply and sewage disposal, bad environmental sanitation, poor socio-economic conditions, poverty, ignorance and bad personal hygiene. Hence in Malaysia as in other countries, cholera is more common in rural (kampongs and rubber estates) and suburban areas. The Table IV

shows distribution of cholera (1961-70) in Malaysia by ethnic group and this bears testimony to the regional distribution of the population in Malaysia and does not indicate that Malays are more susceptible to cholera than the other ethnic groups.

Distribution of cases by sex is shown in Table V. Slightly more males are affected than females.

Age distribution is shown in Table VI. All ages are susceptible but the disease occurs more commonly amongst the active outdoor working adults of either sex and aged between 21-50 years.

**TABLE V**

**Distribution of cholera (1961 and 1969) by sexes**

Year	Male	Female
1961 — Sarawak	143	100
1969 — Kelantan	29	39
	<hr/> 172	<hr/> 139

Carriers play a significant role in the transmission of the disease. Tull (1928) found 2 per cent carriers amongst 700 inoculated persons exposed to cholera

**TABLE VI**

**Distribution of cholera cases by age**

Year of epidemic	Age range in years					
	0-10	11-20	21-30	31-40	41-50	50+
1961 — Sarawak	21	18	50	65	38	51
1969 — Kelantan	11	10	14	15	10	8
	<hr/> 32	<hr/> 28	<hr/> 64	<hr/> 80	<hr/> 48	<hr/> 59

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infections on a quarantined ship in Singapore. The vibrios were excreted in the stools of the carriers for periods of 6 to 32 days. On the other hand (IMR Annual Report 1920), 866 labourers on a rubber estate where cholera had occurred were examined and no carrier was found.

In 1969, during the outbreak of cholera in Kelantan, 125 carriers were detected as compared to 68 cases, i.e. ratio 2 carriers to every 1 case.

### Mortality

Deaths are more common amongst the young, the aged, the undernourished and debilitated persons. The death rate per 100 cases during the cholera epidemics in Malaysia between the years 1900-1970 is shown in Table I. From the table, it is clear that the mortality during early epidemics (1900-1946) was extremely high when the death

rate ranged from 60-82 per cent. However, during the recent outbreaks (1961-1970) the death rate was significantly low. It ranged from 0-30 per cent in East Malaysia and 0-10 per cent in West Malaysia. All the outbreaks of cholera between 1900-1946 were due to classical *Vibrio cholerae* whereas those during 1961-1970 were due to *Vibrio cholerae* biotype *El Tor*. The observed drop in mortality is perhaps chiefly due to the effective modern therapeutic methods and facilities that are available today, rather than to the differences in virulences of *Vibrio cholerae* (classical) and *Vibrio cholerae* biotype *El Tor*.

Table VII shows that the outbreaks in 1961, 1962, 1963 and 1964 were due to the *Ogawa* serotype. However, in 1964 towards the tail-end of the outbreak, some 20 strains belonging to the *Inaba* serotype were isolated. All outbreaks thereafter in 1968, 1969 and 1970 were due to the

**TABLE VII**  
Sero-types of *Vibrio cholerae* biotype *El Tor* strains examined at the Division of Bacteriology, Institute for Medical Research, Kuala Lumpur.

Year	Source & number of strains examined	Identification		
		Biotype	Ogawa	Serotype Inaba
1961	Sarawak — 3	<i>Vibrio cholerae</i> biotype <i>El Tor</i>	+	—
1963	Malacca — Malacca 13 cases Selangor 1 case Muar 3 cases		17	—
1964	Perlis Kedah Kelantan Trengganu Pahang Sabah — 3	525 (2 from water)	508	20*
1965	Selangor — 1 Brunei — 9			
1968	Kedah 9 cases (4 from carriers) Penang 3 cases Perak 1 case Selangor 7 (4 from carriers) Johore 2 cases	22	—	20
1969	Kelantan 80 (44 from carriers)	—	—	80
1970	Penang & P. Wellesley — 28	—	—	28

\* These strains were isolated towards the tail end of the outbreak.

**TABLE VIII**  
**Phage types of *Vibrio cholerae* biotype *El Tor* isolated from 1964-1969**

Year	Source of Strains	Distribution by phage type							Untype-able	Total
		1	2	3	4	5	6	7		
1964	Perlis, Kedah, Kelantan, Trengganu & Pahang	2	—	6	23	—	18	8	2	59
1965	Selangor	—	—	—	—	—	—	1	—	1
	Brunei	1	—	—	—	—	8	—	—	9
1969	Kelantan	—	28	—	4	—	—	—	—	32
		3	28	6	27	—	26	9	2	101

*Inaba* serotype. The change from *Ogawa* to *Inaba* serotypes does not appear to be associated with any significant changes in mortality and morbidity.

### ***Vibrio cholerae* phage types occurring in Malaysia**

Table VIII shows phage types of representative strains of *Vibrio cholerae* biotype *El Tor* isolated between 1962-1964. The strains were phage typed through the courtesy of Dr. S. Mukerjee, WHO International Reference Centre for *Vibrio*, Calcutta. Some 101 strains have been phaged. Only 2 strains were untypable and the remaining strains belonged to 6 of the 7 recognised phage types. No strain belonging to phage type 5 was encountered. The phage types of *Vibrio cholerae* biotype *El Tor*, like the serological types, have been of little or no value in the study of the epidemiology of the disease.

### **Prevention and Control**

It is well known that contaminated water is the important vehicle for the rapid spread of cholera epidemics, while insanitary personal and food habits of the population are largely responsible for the persistence and intensification of transmission of the epidemics. Thus the first preoccupation of health authorities to control cholera is the preservation of the quality of water supplied. This is achieved in Malaysia through constant vigilance and stepping up the chlorine content in the water supplied and chlorination of wells. Human faeces is the main source of infection and it is also well known that cholera outbreaks are associated with situations

in which the water supply is exposed to a high risk of contamination with human faeces due to insanitary defecation habits of the people or when the methods of excreta disposal favour, rather than control, the spread of contamination. In Malaysia, water supply and sewage disposal systems in most urban areas are good, adequate and safe but in the rural and suburban areas (especially before independence) they are still inadequate and there is much room for improvement.

Since independence, through the implementation of successive Government development plans which have given high priority to rural development and education, some modern amenities have become available to rural people and their socio-economic position is somewhat better today, but much still remains to be done so as to bridge the gap in the standard of living between rural and urban populations.

Since independence, the medical and health services are being extended to rural areas, and the development of a National Health Laboratory Service is being given priority. This should ensure more effective and thorough implementation of surveillance programmes. However, all said and done it is realised that it may not be possible to keep cholera out of Malaysia but it is hoped to keep the disease under control by limiting its spread. Nevertheless, we in Malaysia are optimistic that through the continued improvement of the socio-economic position of the masses and the health services in Malaysia, it will not be long before Malaysia is rid of not only of cholera but also other water-borne parasitic diseases, insect-borne



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diseases, communicable diseases, diseases due to poor sanitation and other environmental diseases like malnutrition and deficiency diseases.

### Summary

From time immemorial, cholera has been brought into Malaysia from the neighbouring countries where cholera has been and still is endemic and epidemics of the disease have taken their toll in human lives.

Records (earliest date back to 1828-30) show that Malaysia has been invaded by seven successive cholera pandemics\* since the first pandemic in 1817. During the first pandemic, cholera reached Malaysia in May 1829, i.e. two years after the epidemic had ravaged India. The details pertaining to the cholera epidemics in Malaysia from 1900-1970 are shown in Table I. Between 1900-1946, six epidemic outbreaks of cholera were recorded in West Malaysia and one in Sarawak. All these outbreaks were due to the classical *Vibrio cholerae*. From 1946 to 1961, Malaysia was free from cholera. In 1961, the present *El Tor* cholera pandemic invaded East Malaysia and in 1963, it reached West Malaysia. The disease has spread to all the states in Malaysia and has continued to smoulder with recurrences in 1962 (Sabah and Sarawak), 1963 (Malacca, Selangor, Johore, Perak and Sarawak), 1964 (Kedah, Perlis, Trengganu, Kelantan, Pahang, Perak, Johore, Sabah and Sarawak), 1968 (Kedah, Penang, Perak, Selangor, Johore and Sarawak), 1969 (Penang, Kelantan and Trengganu) and 1970 (Penang and Province Wellesley).

In 1965, there was one single isolated case and in 1966 and 1967, there were no cases.

The outbreaks (1961-70) were due to *Vibrio cholerae* biotype *El Tor*. The strains isolated and examined at the Institute for Medical Research, Kuala Lumpur from 1961-1965 were serotyped as *Ogawa*. However in 1964, of the 528 strains examined, 20 isolated towards the tail-end of the outbreak, were serotyped as *Inaba*. From 1968-1970, all the strains isolated and examined were serotyped as *Inaba*.

Records show that though Malaysia has often been invaded by cholera in the past, and the disease has spread and assumed epidemic proportions, the disease has never truly become endemic here. The records also show that cholera outbreaks usually

start during the dry spell in May, June and July and that the outbreaks terminate with the onset of the rainy season.

Cholera is a disease of ignorance, poverty, insanitary water supply and sewage disposal, bad personal hygiene and environmental sanitation. Under these circumstances, in Malaysia like other countries, it is little wonder that the disease is more prevalent amongst the people living in the rural and suburban areas. It commonly affects adults, aged 20-40 years who are engaged in outdoor work, and hence in Malaysia more males are affected than females.

The mortality rate, which ranged from 60-80 per cent in the outbreaks between 1900-1946, came down to 0-30 per cent in 1961-1970. This is partly due to better medical facilities and treatment available these days and partly perhaps to the fact that *Vibrio cholerae* biotype *El Tor* is less virulent than the classical *Vibrio cholerae*.

To date, some 101 strains of *Vibrio cholerae* biotype *El Tor* isolated in 1964, 1965 and 1969 in West Malaysia and Brunei have been phage typed. This has been made possible through the courtesy of Dr. S. Mukerjee. The strains were grouped into 6 of the 7 recognized phage types, namely 1, 2, 3, 4, 6 and 7. No strain belonging to phage type 5 has been recognised in Malaysia. Only two strains were untypable. The *Vibrio cholerae* biotype *El Tor* phage types like the serological types of strains examined, have been found to vary in different outbreaks and also within the same outbreak and hence have been of scarcely any use in the study of the epidemiology of the disease.

Finally a word on the future of cholera in Malaysia. We are optimistic that through the continued improvement of the socio-economic position of the masses and the medical and health services especially in the rural areas, before long Malaysia will be rid not only of cholera but also of a host of other water-borne and insect-borne diseases, communicable diseases, and diseases due to poor sanitation and other environmental diseases like malnutrition and deficiency diseases.

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* First pandemic	1817—1823	6 years	} Pollitzer (1959)
Second "	1826—1837	11 "	
Third "	1846—1862	16 "	
Third "	1864—1875	11 "	
Fifth "	1883—1896	13 "	
Sixth "	1899—1923	24 "	
Seventh "	1961— to date	10 "	

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