

INTEREPIDEMIC VIBRIO CHOLERA INFECTIONS, BANGKOK, 1959-1960

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Introduction.

Cholera epidemics of three to five years duration have occurred repeatedly in Thailand. Siddhichai and Grayston (1) have postulated that reintroduction of the etiologic agent rather than extension of infection from endemic foci in Thailand has been responsible for each outbreak. Previous epidemiological investigations have not included studies of the distribution of *Vibrio comma* in any part of the country during periods when no cases of overt clinical cholera were being observed.

Abou-Gareeb (2) working in Deshapara Village, India, in 1959, reported that although clinical cholera had not been observed there for more than two and one-half years, *V. comma* could be readily isolated from both water tanks (ponds) and asymptomatic persons living in the area. He suggested that the basis for evaluating endemicity of cholera should be biological rather than recognition of the disease in man.

Data suggesting that this pathogenic agent might persist in the environment during interepidemic periods in Thailand were first presented by Orth and his co-workers (3) who isolated *V. comma* from the water of many klongs (canals) and a wide variety of foodstuffs in Bangkok during March and April, 1959, when the incidence of clinical cases was declining. Morgan (4) reported positive isolations of *V. comma* from patients with mild diarrhoea in Bangkok until July, 1960, a period during which severe clinical cholera was not recognized in the community.

The present study concerns persistence of *V. comma* in selected urban areas in Thailand during the period immediately following an epidemic of cholera which occurred in that country during 1958 and 1959.

Materials And Methods.

Bangkok, the capital city of Thailand, with a population of 1.5 million people, and the city of Dhonburi, Thailand, with a population of 450,000, lie opposite one another on the banks of the Chao-Phraya river. The present investigation was conducted in these twin cities during the period November 1959 through August 1960. Studies concerned the distribution of *V. comma* and other enteric pathogens in several selected population groups and in food and water. All patients with diarrhoea who reported to several hospitals

in Bangkok and Dhonburi were included in the study. These institutions were the Dindaeng Infectious Hospital, Pramongut Klao Army Hospital and Children's Hospital in Bangkok and the Dhonburi Municipal Hospital and the Pin Klao Navy Hospital in Dhonburi. Both the Dindaeng Infectious Hospital and the Dhonburi Municipal Hospital were infectious disease hospitals and each operated out-patient clinics. At these institutions in-patients and out-patients were investigated. Only in-patients were included from the remaining hospitals. Periods of study were different for each of the institutions. These dates are presented in Table 1. Patients were observed for the signs and symptoms of classical cholera and were examined bacteriologically for intestinal pathogens.

Healthy school children were surveyed for the presence of *V. comma* and other enteric pathogenic bacteria. Two schools attended by children from families of different socio-economic status were selected as the site for these studies. These were the Huey Kwang School and Ladies School. At the Huey Kwang School all children who were known household contacts of persons found to be excreting *V. comma* were included provided they had no overt symptoms of disease. Other healthy children were selected at random. An arbitrary decision was also made to include

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Table 1
BACTERIOLOGIC FINDINGS IN DIARRHEAL CASES
reporting to hospitals in Bangkok and Dhonburi
Nov. 1959 - Aug. 1960

Hosp. No.	Name and location of hosp.	Period of Study	No. of patients	No. of samples	Age	Organism isolated						
						Ogawa	Inaba	Hiko-jima	All V. comma	NAG vibrios	Salmo-nellae	Shi-gellae
1	Dindaeng Infectious Hospital	21 Nov 59 29 May 60	677	874	3 mos- 98 yrs	63	36	1	100	100	69	30
2	Dhonburi Municipal Hospital	3 Dec 59 31 Aug 60	648	659	4 mos- 76 yrs	29	14	1	44	104	30	23
3	Pramongut Klao Army Hospital	11 Dec 59 31 Aug 60	76	369	18 yrs- 36 yrs	8	3	1	12	4	6	1
4	Children's Hospital Rachavithi Road	23 Feb 60 26 Apr 60	280	282	4 days- 16 yrs	2	4	—	6	17	17	3
5	Pin Klao Navy Hosp. Dhonburi	8 Mar 60 31 Aug 60	123	123	10 days- 19 yrs	1	—	—	1	10	16	7
	Total		1804	2307		103	57	3	163	235	138	64

the school's janitor in the study group. At Ladies School, a high-class private institution attended by children from upper income families, healthy students were selected at random. Specimens were collected daily by means of rectal swabs during two different study periods at both institutions. At the Huey Kwang School the first survey continued from January through March 1960, but only during two weeks in March 1960 at Ladies School. Study groups at each school were resurveyed in June 1960.

The second phase of the study concerned the distribution of *V. comma* in food and water. Food samples were collected weekly from the Huey Kwang, Dindaeng and Pratunam Markets. All were in Bangkok and their locations are shown in Figure 1. Samples consisted of raw vegetables, fish, shrimp, shellfish, various meat products, desserts and cooked foods which had been allowed to cool prior to selling.

Raw water was obtained weekly from sites along the main river and the main drainage klongs. Stagnant water from a few ponds was also sampled periodically.

Samples of the municipal water supply were obtained from taps in a few houses and from the main city water supply.

A special investigation was made of an epidemic of diarrheal disease which occurred in the Huey Kwang Government Housing Project during November and December 1959. Cases of diarrhoea were studied clinically and bacteriologically and rectal swab specimens were obtained whenever possible from household contacts of patients found to be excreting *V. comma*. Food and water were also examined for bacterial contamination. Food samples included raw vegetables and a variety of cooked food which had been allowed to stand before consumption. Water subjected to bacteriological examination was obtained at weekly intervals from jars used for storage in houses and from the surrounding klongs.

Bacteriological cultivation and identification of all pathogenic enteric bacteria from the materials under study were performed in the Thailand-SEATO Cholera Research Laboratory.

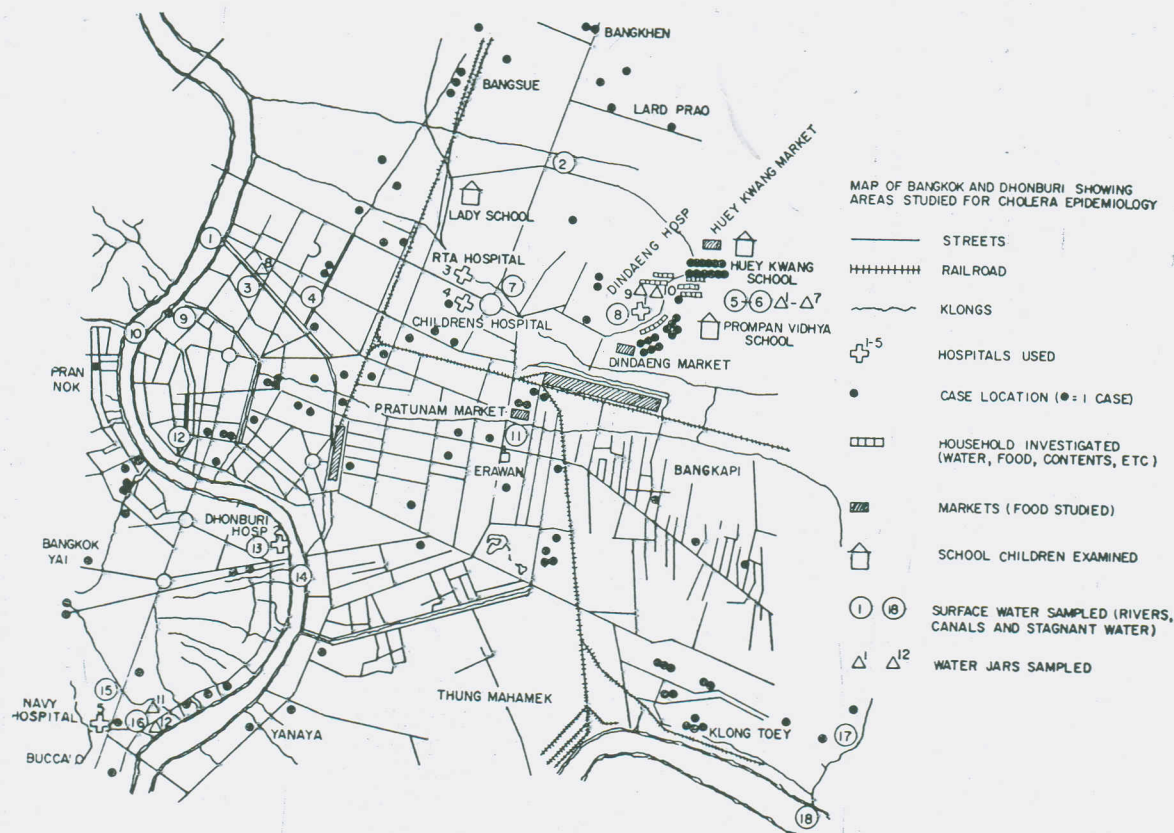


Figure 1.

Results.

Patients with Diarrhoea.

Patients who reported to the Dindaeng Infectious Hospital and Dhonburi Municipal Hospital came from all districts of the twin cities and surrounding suburban areas. Diarrheal disease was the chief complaint in a large proportion of the admissions in all age groups. Both hospitals were believed to serve as excellent listening posts for determining the etiology of enteric infections in the lower economic segments of the population. Patients accepted for study at the military hospitals were from all economic groups and appeared to represent a better sample of the distribution of enteric infections in the total population.

Results of bacteriological studies performed on this group are presented in Table 1. A total of 1804 patients were studied and from these a total of 2307 specimens of feces were obtained for bacteriological examination. The average number of specimens per patient at the Pramongut Klao Hospital was 4.86 and at all other institutions varied from 1.00 to 1.29.

Age of the individuals included varied from four days to ninety-eight years. Both children and adults were represented among the cases at all hospitals except the Pramongut Klao Army Hospital where only adults were accepted.

No severe cases of cholera were observed during the entire study period.

Vibrio cholerae of the Ogawa, Inaba and Hikojima types were isolated from 163 patients. The highest proportion of positive results came from the Dindaeng Infectious Hospital where 37.9 per cent of the specimens yielded typeable cholera organisms. Next in order was the Dhonburi Municipal Hospital with 28.6 per cent positive cases, followed by the Army Hospital 16.0 per cent, Children's Hospital 12.2 per cent and the Navy Hospital 5.3 per cent. Among the 235 specimens positive for nonagglutinable (NAG) vibrios, the largest proportion of positive results were again obtained in the Dindaeng Infectious Hospital and the Dhonburi Municipal Hospital. Salmonella and Shigella infections were also identified more frequently among patients admitted to those two institutions.

The number of diarrheal cases examined monthly and number of *Vibrio comma* Salmonella and Shigella isolations obtained each month are presented in Figure 2. The highest proportion of *Vibrio comma* isolations occurred during the months of November and December. Both the total number and proportion of *Vibrio comma* isolations decreased sharply in December and gradually declined thereafter. In July and August of 1960 a total of 151 cases were examined but no *Vibrio comma* were cultivated.

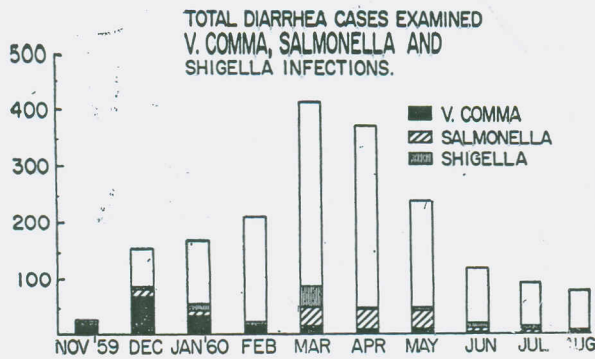


Figure 2.

Figure 1 is a map of Bangkok and Dhonburi. Each dot on the map represents a patient with diarrhea who was found to be excreting *Vibrio comma* of either the Ogawa, Inaba or Hikojima types. These cases are distributed throughout all districts of the two cities. This distribution was observed from the beginning of the study and suggests that there was no common reservoir or site of infection. The concentration of cases in the Huey Kwang district can possibly be accounted for by the close proximity of the infectious disease hospital in Bangkok. The Klong Toey district is considered one of the slum areas of Bangkok and is without an adequate municipal water supply, which may account for the apparently high number of cases in that area.

Survey of apparently healthy school children.

At the Huey Kwang School a total of 20 normal school children and the school janitor were selected for daily examinations. Of these children, nine were known household contacts of diarrheal cases which had been found to be excreting *Vibrio comma*, and 11 additional children were chosen at random. All came from families of the lower income group who were living in the Huey Kwang Government Housing Project. At no time during the study did any of these children admit having diarrhoea but *Vibrio comma* was isolated at least once from fifty per cent of the total study group. The excretion of *Vibrio comma* occurred intermittently in 5 children, while both Ogawa and Inaba type organisms were isolated from each of 2 children at different times.

At the Ladies School, a high-class private institution, the total group selected for daily rectal swab examinations included 15 healthy children. *Vibrio comma* was not isolated from this group at any time but this study was limited to two weeks in March, a period during which *Vibrio comma* was not particularly widespread throughout the community.

A repeat survey of 36 children was undertaken at the same schools in June for a period of two weeks. *Vibrio comma* was not found during that time.

Results of these studies are summarized in Figure 3.

Contamination of food stuffs.

Two of the markets, Huey Kwang and Dindaeng, from which food samples were obtained for bacteriological examination, were patronized chiefly by people in the lower income group who lived nearby. The Pratunam Market was much larger, centrally located, and was frequented by persons living in areas throughout Bangkok. The location of the 3 markets is shown in Figure 1. Practically all types of food samples obtained from all of these markets were found at one time or another to be contaminated with *Vibrio comma*. Raw vegetables yielded the highest percentage of bacteriological isolations. Foods from these markets were found to be contaminated with *Vibrio comma* until June 1960, but no isolations were made during July or August of that year.

Contamination of raw waters.

Locations in the two cities from which water samples were taken regularly are shown in Figure 1. Those which represent sampling points for water from rivers, canals and ponds are shown by encircled numbers. Of these sampling points 1, 10, 14, and 18 are distributed along the course of the Chao-Phraya river. Samples of water from the canals were obtained at those points indicated by numbers 2, 7, 11, 15, 16 and 17. Those sampling points which remain, represent sites from which samples of stagnant water were obtained from ponds. Water samples from taps in houses were obtained in those homes indicated on the map by small crosshatched rectangles and samples from water jars were obtained in those areas indicated by a small triangle.

Water from each of these points was found to be positive intermittently for *Vibrio comma* until the month of June at which time isolations became very infrequent. The last two locations which remain positive until the first week of July 1960 were sites 1 and 18 on the river. Since that time, all surveys of water samples have been negative for *Vibrio comma*. The municipal water supply in Bangkok was found at no time to contain intestinal pathogens during the period of this study.

Figure 4 shows the percentage of isolations of *Vibrio comma*, Shigella and Salmonella from all diarrheal patients and compares these results during each month in the study period to the proportion of positive samples of food and water obtained during the same time intervals. The trend of the decline in the isolation of *Vibrio comma* from patients as well as from food and water can readily be seen from December 1959 through August 1960 at which time the cholera organism became conspicuous by its absence.

Contacts and environmental studies.

Many cases of diarrhoea occurred in the Huey Kwang district during November and December of

pattern of positive isolations from household members, food and from water other than that supplied through the municipal water distribution system continued through May 1960, but subsequently all results have been negative for this organism.

Monthly incidence of V. comma sero-types and nag vibrios.

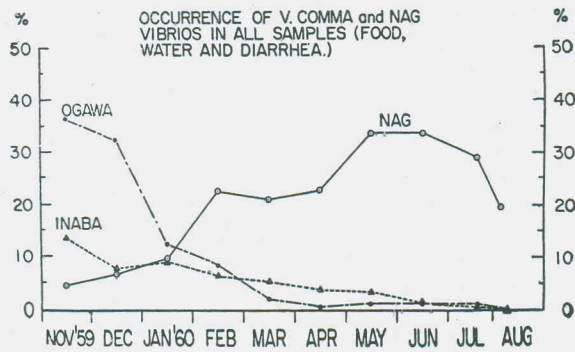


Figure 5.

Figure 5 shows the percentage of Ogawa, Inaba, and nonagglutinable vibrios isolated from all samples of food, water and from diarrhoeic patients from November 1959 through August 1960.

Mode of transmission.

Whenever the klong and river waters of Bangkok and Dhonburi contain *V. comma*, the contamination of the various foods and stored drinking water can be ascribed to local customs and practices. The klong are used by a great many people of the lower income group; to bathe in, to wash clothes and dishes, as well as to grow vegetables and fish. It is a common practice for the farmers to wash and sprinkle vegetables with klong water on the way to the markets. The practice of many families of cooking food once or twice daily in the early morning or in the evening and allowing it to cool and be consumed throughout the remainder of the day offers an excellent opportunity for contamination by unclean hands. Drinking water stored in jars is easily contaminated by dipping it out with a pan. With this contamination, many persons ingest *V. comma* and other intestinal pathogens. Some develop diarrhoea

while others remain as symptomless excretors of the organisms. Human excreta in various areas of Bangkok and Dhonburi inevitably reach the klongs and the river which favors a sustained cycle.

Summary.

At the beginning of this study, *Vibrio comma* was widely distributed throughout Bangkok and Dhonburi. During November and December of 1959, approximately 40 per cent of the mild diarrhoea cases were excreting *V. comma* in the absence of severe cholera. Surface water and food in Bangkok and Dhonburi were found to be contaminated with *V. comma*. A survey of apparently healthy school children and contacts revealed a large number of symptomless excretors of *V. comma*. From January 1960 until August 1960 there was a gradual decline in the isolation of *V. comma* from all sources, with complete disappearance in the month of August.

In conclusion, it appears that the title of this paper, "Interepidemic Vibrio Cholera Infections, Bangkok" is perhaps a misnomer. Our data indicate that the Bangkok cholera epidemic which exploded in May of 1958 probably came to an end in August of 1960. *V. comma* does not appear to remain biologically endemic in Thailand. However, continuation of the present studies on a limited basis at least through the peak of the 1961 diarrheal season is desirable and perhaps for an indefinite period thereafter.

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