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Spatial and temporal patterns of cholera outbreaks in Sri Lanka

RMK Ratnayake

Dept. of Geography, University of Sri Jayewardenepura, Sri Lanka

Abstract

Among the medical health problems faced by Sri Lanka, the prevalence of cholera is in many parts of the island. Although in the recent past cholera was not considered a dreaded disease, the country had experienced a recorded history of cholera back from 1841. From time to time cholera reached epidemic proportions. Regional variations can also be observed in the distribution of the disease during those periods. The objective of this study is to analyse the spatial and temporal pattern of the cholera outbreak in Sri Lanka. Data for the study was obtained from numerous secondary sources, unpublished theses and from filed work conducted in North Colombo and the Kurunegala District. Two major high risk areas were identified viz; the underserved areas in the Colombo and suburban area and the Dry Zone district. In urban areas, there are lack of sanitation facilities and in Dry Zone the floods and drought is the main courses for the cholera epidemic.

Keywords: cholera, epidemic, disease, sanitation, medical geography

1. Introduction

Among the medical health problems facing Sri Lanka is the prevalence of cholera in many parts of the island. Although in the recent past cholera was not considered a dreaded disease, the country has experienced a recorded history of cholera back to 1841. From time to time cholera reached epidemic proportions. Regional variations can also be observed in the distribution of the disease during those periods. This paper attempts to analyze the temporal and spatial distribution pattern of cholera in the country during three epidemics, viz; 1973/74, 1991/92 and 1997/98. Data for the study was obtained from numerous secondary sources such as the epidemiological reports, Annual health bulletins in Health Ministry, publish research papers and unpublished theses by Mendis (1975 and 1977) [2, 1] Mendis and Fernando (1977) [3], Mertens *et al.* (1992) [4], Kariyawasam (1993) [5] etc; and from filed work conducted in North Colombo and the Kurunegala District.

2. History of Cholera in Sri Lanka

Data obtained from epidemiological reports state that there were a total of 16,869 cholera cases between 1841 and 1850, within reporter 10,296 deaths (Table 1 and Fig.1). The number of cholera patients had increased to 35,811 with a case Fatality Rate (CFR) of 68 during the next decade. Although there was a decline in the morbidity and mortality rates in the period between 1861 and 1870, there was a rapid increase in the number of cholera patients to 36,756 in the following decade. However the CFR had decreased to 54. After 1881 there was a rapid decline in the number of cases to 54 during 1931-1940 although the CFR had increased to 84. A Slight upward trend was to be observed in the following decade. After an interval of several years, there were outbreaks of cholera once again in 1974/75, 1981, 1988, 1991/92 and in 1997 (Table 2 and Fig.2).

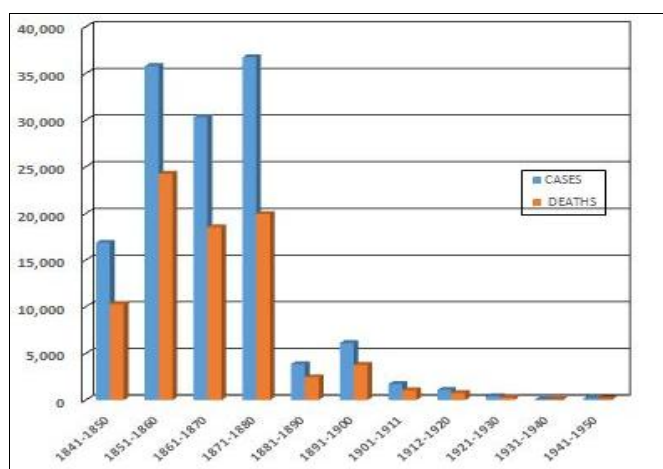
Cholera is an acute diarrheal disease that is caused by *V. Cholerae* 01 (classical or EI Tor). The EI Tor biotype appeared in Sri Lanka in 1973. In 1993, a new zero group was identified

in Sri Lanka, designated as *V. Cholerae* 0139 (Bengal).

Table 1: Cholera in Sri Lanka 1841-1950

YEAR	NO. OF CASES	NO. OF DEATHS	CASE FATALITY RATE(CFR)
1841-1850	16,869	10,296	61
1851-1860	35,811	24,254	68
1861-1870	30,324	18,523	61
1871-1880	36,756	19,960	54
1881-1890	3,868	2,452	63
1891-1900	6,127	3,765	62
1901-1911	1,718	1,064	62
1912-1920	1,104	763	69
1921-1930	424	280	66
1931-1940	94	79	84
1941-1950	242	164	68

Source: Administrative report of the Director, Quarantine Department 1951



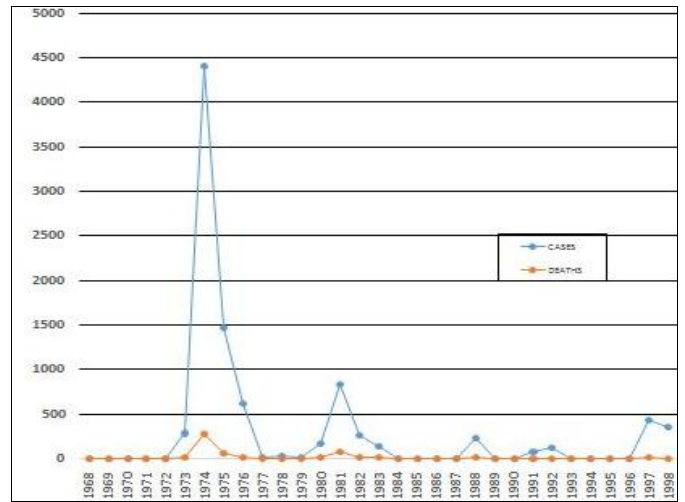
Source: Administrative report of the Director, Quarantine Department 1951

Fig 1: Cholera in Sri Lanka 1841-1950

Table 2: Cholera in Sri Lanka 1968-1991

Year	CASES	DEATHS	NO. OF FATALITY RATE (CFR)
1968	0	0	0
1969	0	0	0
1970	0	0	0
1971	0	0	0
1972	0	0	0
1973	284	8	3.2
1974	4405	279	6.3
1975	1470	55	3.7
1976	610	11	1.8
1977	12	0	0
1978	33	1	3
1979	11	0	0
1980	174	14	8
1981	832	72	8.6
1982	267	15	5.6
1983	134	7	5.2
1984	0	0	0
1985	0	0	0
1986	0	0	0
1987	0	0	0
1988	235	7	3
1989	0	0	0
1990	0	0	0
1991	70	2	2.9
1992	121	2	1.7
1993	1	0	0
1994	0	0	0
1995	0	0	0
1996	0	0	0
1997	430	12	2.8
1998 18 th June	359	5	2.5

Source: Epidemiological Unit, Sri Lanka



Source: Epidemiological Unit

Fig 2: Cholera in Sri Lanka 1868-1998 (June 18th)

The outbreak of Cholera EI Tor in 1973/1974

Cholera EI Tor was first detected in Jaffna in the northernmost part of the island in October 1973 and spread to the neighboring district of Vavuniya. In December, the focus of infection had shifted 250 miles to Colombo Metropolitan Region (CMR) especially to the area on either side of the river Kelani (Fig.3). From this focus, the disease had spread to other areas in the vicinity Medical officers of health (MOH). By March and April 1974, people in areas that were further away from the focus such as Anuradhapura, Kurunagala and Kandy were affected (Fig.3).



Fig 3

The average incidence rate of Cholera for Sri Lanka was 33.7 per 100,000 and the highest incidence rates of 183.2 and 132.1 per 100,000 had occurred in the Dry zone Districts of Vavuniya and Anuradhapura respectively (Fig.4).

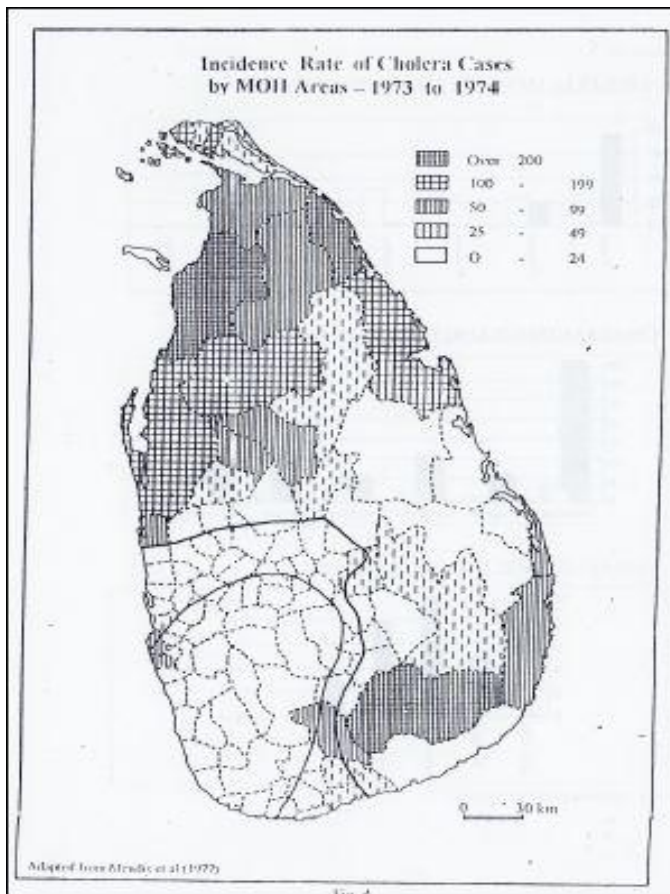


Fig 4

Affected areas can be classified into two climatic Zones viz; the wet Zone districts (highly urbanized and densely populated) and Dry and Intermediate Zone Districts (agricultural – rural). Fig.5 shows the number of cholera cases recorded in each superintendent of Health Services (SHS) Division in the wet and Dry Zones during 1974. From February to the end of 1974, the number of cholera cases in Sri Lanka had increased from 106 to 538 with peaks in the months of May (422), July (565) and October (587). Except for Colombo SHS Division in the CRM with 736 cases and 37 deaths, the other Wet Zone areas were not as adversely affected as the Dry Zone areas of Anuradhapura (855 cases), Jaffna (671 cases), Badulla (494 cases) and Vavuniya (350).

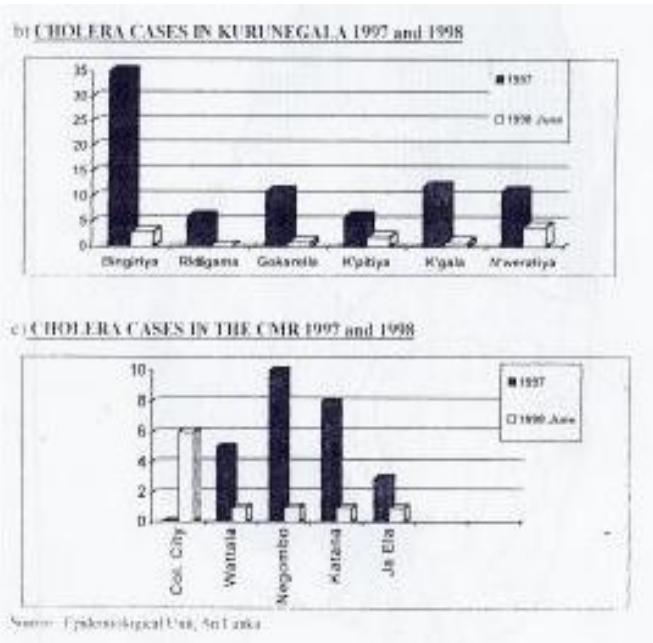


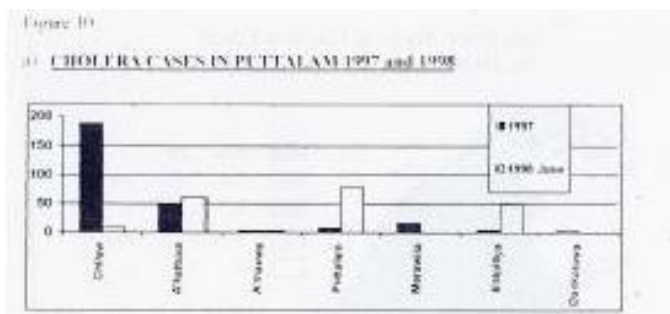
Fig 5

The distribution of cholera patients were distributed on either side of the river Kelani viz; in the Mahawatta MOH area in North Colombo (South of the river) and in the Peliyagoda MOH area located to the north of the river. A number of factors had led to the concentration of cholera cases in this region viz;

- high density of population especially in the unauthorized squatter settlements;
- Inadequacy of sanitation facilities and potable water in the squatter settlements;
- Curtailement of the pipe borne water supply by local authorities due to prolonged drought;
- use of faecally polluted river water for bathing and for washing vegetables and cooking utensils due to lack of knowledge and correct attitudes;
- Pollution of river water caused by the pumping of untreated sewerage into the river.

Cholera in the Dry Zone (inclusive of the Intermediate Zone) 1973-1974.

The Dry zone is characterized by low and variable rainfall that is received during a few months of the year. The region is predominantly an agricultural-rural area which is dependent on irrigated water for the cultivation during the dry season. Research conducted by Mendis *et al* (1977) ^[3] Revealed that the inadequacy of water during the long dry season and the absence of facilities has contributed to the spread of cholera in these areas. In Vavuniya, Badulla, Batticaloa and in Hambanthota in the Matara SHS area there was an influx of migratory agricultural laborers during the harvesting season when there was a scarcity of rainfall. These labourers as well as shifting cultivators lived in temporary huts without adequate sanitation or water supply. Water was obtained from nearby streams or wells dug out in river beds. It was discovered that most of the cholera patients had lived either on the banks of river such as the Malwatu oya, Kirindi oya, Mau



ara or near canals and reservoirs. Other patients were from temporary villages of migratory fishermen who used water from shallow wells (3-4 ft deep) dug on the beach.

Inadequacy of potable water and sanitation facilities for permanent residents was another contributory factor as illustrated by the situation in the congested Kalmunai MOH area which had a population of 12,000.

“Each house has a small compound and practically every house had a well. There are hardly any latrines in the locality as there is no space to construct them. The disposal of night soil is by shallow burial within the back compound very close to the well. The water table is quite high and it is likely that there is considerable pollution of the sub soil water.” (Mendis *et al*).

The region Still thousands of people from all parts of the country for religious festivals was in 1974 were not provide adequate water and sanitation facilities to pilgrims and also to dissuade people from arriving in large numbers. These measures were successful to a great extent.

The Cholera outbreak of 1991/1992

Unlike in the 1973/74 epidemic, out of 70 positive cases that were detected in Sri Lanka 80 per cent were concentrated in the Colombo Metropolitan Region particularly in those areas that had experienced the cholera epidemic in 1973/74 viz; in the northern part of the city of Colombo and in the suburbs along the river Kelani. In 1992, of the 121 cholera cases in Sri Lanka, nearly 60 per cent had lived in this area.

Cholera in the city of Colombo

The attack rate for Colombo North was 27 per 100,000 in contrast to 4.0 for the whole country. This area is characterized by marshes and low lying land that is prone to floods. The region contains a large concentration of low income communities (LICs) living in slums, squatter settlements or shanties and unserved neighborhoods (fig 6). In 1993 only 10 per cent of the LICs in north Colombo had an “adequate” sanitation coverage (Greater Colombo wastewater and Sanitation Master plan, 1993) which means that the reminder had either marginal (26-50 persons per facility) or grossly inadequate (more than 100 persons per facility) Sanitation facilities (fig 6). Approximately 16 per cent of the LICs were provided with an “adequate” water supply ie. Not more than 50 persons per piped water source.

In the Mahawatta ward in north Colombo, three major concentrations of squatter settlements with a total of 461 dwelling units were served by 7 stand pipes and 4 public latrines in 1993. In

Aluthmawatha ward, 3300 persons were living in 504 huts. They were provided with 5 stand pipes and 12 toilets. Since these facilities were not sufficient, 74 shallow latrines and 12 unauthorised and unprotected dug wells had been constructed by the squatters. Fig 6 shows the distribution of water and sanitation facilities in 3 settlements Known as Kusum Sevana Watta, 4202 Garden and 484 Garden. During heavy rains and floods, contaminated water from latrines spread over whole area covering the wells, vegetables plots and marshes (fig 6).

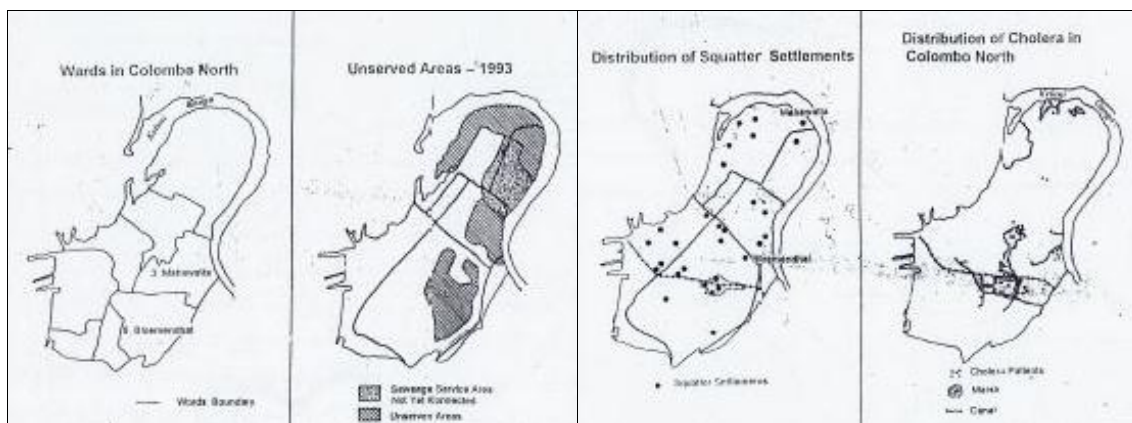


Fig 6

V. cholera 01, EI Tor was first detected in a squatter Settlement in Mahawatta in July when there was heavy rain in Colombo. A few days later the disease spread to the adjoining LICs at Madampitiya and Ferguson road (Wanasinghe, 1995) [6]. The epidemic reached its peak in August.

In April 1992, cholera was once again detected in the city, predominantly in north Colombo during a severe drought period with a shortage of water in the city. The use of contaminated river water for bathing and washing, drinking water that was not boiled was considered a major contributory factor in the spread of the disease (Kariyawasam, 1993) [5]. Food-borne transmission was also responsible for the spread due to factors such as insanitary food preparation and handling methods in the household, in eating horse or by road side food vendors and to the consumption of “keera” or greens grown in facially polluted marshy areas.

Cholera in the suburban areas of the CMR

The waste water and Sanitation Master plan (1993) provides a detailed account of the distribution of cholera in suburban areas in 1992. The majority of cases detected were from LICs in the Kolonnawa and Kelaniya MOH areas located on either side of the river Kelani. Of the 57 patients, 54 were living on the banks of the river. The outbreak occurred during drought when water supply from stand pipes was reduced and the LICs had to depend on the contaminated river water. The sanitation coverage for 72 per cent of the LICs in the Kolonnawa MOH area was described as marginal, inadequate or grossly inadequate. As much as 70 percent of the area in which the Low income settlements (LISs) are located is low lying with ground levels bellows 3 m MSL in certain sections. In the Kelaniya MOH area to the north of the river, less 10 per cent of the LICs had a marginal sanitation coverage while the

remaining population had either an inadequate or a grossly inadequate coverage.

The Cholera outbreak of 1997/1998

The Dry Zone

The most recent cholera outbreak occurred in September 1997 in the Dry Zone district of Chilaw area in the Puttalam Deputy provincial Directors of Health Services (DPDHS) Division. Chilaw had recorded 188 cases with 3 deaths – the highest number of cases in the country, while the whole DPDHS Division had a total of 268 cases and 6 deaths. Within three months after cholera was first detected, it had spread eastwards to the adjoining district of Kurrunagala and Southwards to Gampaha located in the northern part of the CMR. In 1998, a number of change can be observed viz; the overall reduction of cholera cases in Puttalam, Kurrunagala and Gampaha; inter regional shifts within these areas such as the increases Puttalam and Kalpitiya MOH areas and the decline in Chilaw from 188 to 9 by June 1998; the spread of the disease to new areas such as Trincomalee, Ampara and Badulla and the increase in the number of cases in DPDHS divisions such as Monaragala. It should be noted that the majority of cases were confined to the Dry Zone Districts. The spread of cholera in this region has been attributed to floods, lack of safe water and adequate sanitation facilities in the region particularly in the congested refugee camps. Field surveys by the authors conducted on 41 cholera patients and their families in the Chilaw (DPDHS) area in November 1997 revealed that water for drinking purposes was obtained mainly from a few stand pipes in the area or from unprotected wells. As much as 86 per cent did not use boiled water for drinking. Further, 76 per cent used pit latrines or water sealed latrines while the rest used the beach for defecation. All the patients stated that they were not in the habit of using soap for washing after using the toilet but 66 per cent used to wash hands before taking a meal. Their behavior indicates that they did not have the necessary knowledge and attitudes to take precautionary measures. The education level of the patients and most of the family members was low; 41 per cent had received an education below Grade 5 level and 25 per cent between Grades 6 and 10. The occupation structure indicated that the majority were farmers, fishermen or agricultural laborers.

The CRM

Another notable feature is the absence of cholera in the city of Colombo until June 1998 when a group of railway workers had returned from a cholera area. However the city is a major high risk area. It has a resident population of over 700,000, 40 per cent of whom are LICs and about 1.5 million transients and commuters who travel to Colombo daily from all parts of the country. The city provides prepared food for a large number of people. Most of the low and lower-middle income groups purchase food and drinks from the numerous small eating houses, bakeries, way side stalls and mobile food vendors. Although 48 Public Health Inspectors (PHIs) are required to serve the city only 27 have been appointed so that close surveillance of all the food handling establishments cannot be undertaken. A recent survey revealed the unhygienic state of the kitchens and back yards of the smaller eating houses. It was reported that certain eating house in the densely populated areas had used contaminated water from shallow (10 ft. deep) tube wells. The construction of tube wells is

forbidden unless they have a depth of 30-40 ft to prevent polluted underground water from being used for drinking and washing fruits and vegetables. Another cause for concern is the inadequacy of water and sanitation facilities for LICs.

Conclusions

The study attempted to highlight the nature of temporal and spatial variations of cholera in Sri Lanka and to identify factors responsible for the spread of the disease. Two major high risk areas were identified viz; the underserved areas in the CRM and the Dry Zone district.

The historical analysis shows that the forces of infection has shifted during each outbreak from the northern Dry Zone in 1973/74 to the CMR 1991/92 and again to the north western part of the Dry Zone in 1997 and that the disease occurs during periods of heavy rain and floods as well as during periods of severe drought.

Concerted efforts made by the authorities to provide water and sanitation facilities and to improve the quality of life of LICs in Colombo city and the precautionary measures undertaken in 1998 have reduced the number of cholera patients in the city. The Dry Zone Districts are more vulnerable due to a number of factors such as the recurrent floods and droughts; inadequacy of water and sanitation facilities for the permanent residents in the area as well as for the thousands of pilgrims who visit sacred places every month and for refugees living in congested camps.

Most of the factors responsible for the spread of cholera can be controlled though health education programmes this provide knowledge, create awareness and inculcate correct attitudes among school children and the general public and by providing more water and sanitation facilities.

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