ROLE OF WATER SUPPLY AND SANITATION IN THE INCIDENCE OF CHOLERA IN REFUGEE CAMPS

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PREFACE

The International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) is an autonomous, international, philanthropic and non-profit centre for research, education and training as well as clinical service. The Centre is derived from the Cholera Research Laboratory (CRL). The activities of the institution are to undertake and promote study, research and dissemination of knowledge in diarrhoeal diseases and directly related subjects of nutrition and fertility with a view to develop improved methods of health care and for the prevention and control of diarrhoeal diseases and improvement of public health programmes with special relevance to developing countries. ICDDR,B issues two types of papers: scientific reports and working papers which demonstrate the type of research activity currently in progress at ICDDR,B. The views expressed in these papers are those of authors and do not necessarily represent views of International Centre for Diarrhoeal Disease Research, Bangladesh. They should not be quoted without the permission of the authors.

ABSTRACT

We wanted to examine the effect of the use of covered latrines and the source of water supply in the incidence of cholera. We recorded all confirmed cholera cases admitted to ICDDR,B hospital from three different refugee camps located in Dacca city. The major differences in the camps were the presence of piped water supply and sewage connected latrines in one camp; and hand pump tubewells, ponds and surface latrine in the other two. In the camp with sanitation facilities, the rate of cholera was 1.6 per 1000. In the two camps without such facilities, the rates were 4.0 and 4.3 per 1000. These rates were half during the following year in the same areas after the camps were removed. The rates in areas with no change remained the same. The study shows a significant association of the incidence of cholera with the use of open latrines and the open sources of water. It reveals further that along with facilities awareness of health and hygiene is essential for proper impact of sanitation on cholera incidence.

INTRODUCTION

John Snow was the first to observe transmittion of the cholera agent through water (1). Since his time many workers have documented the transmission of cholera bacteria from stool to water and back to man. Mathew and Benjamin from India (2,3), Mosley (4,5), Hughes (6), Khan (7), Sommer (8) and Spira (9) from Bangladesh have shown that epidemics of cholera were due to transmission of *Vibrio cholerae* through open water sources. But Van de Linde from Hong Kong (10), Sinha from India (11) and Bart from Bangladesh (12) have traced cholera epidemics to isolation of *Vibrio cholerae* from night soil. In many developing areas people contaminate ponds, canals and rivers by passing stool on their banks and also by washing the anus after defecation in these sources of water. The same water is also used for bathing, washing and irrigation. In such situations tubewells do not protect people from cholera and diarrhoea (13,14,15).

In order to elucidate the possible roles of open latrines and surface water in the transmission of cholera, compared to closed latrines and piped water we followed the incidences of cholera in 3 major refugee camps during the cholera epidemics of Dacca in 1974 and 1975.

MATERIALS AND METHODS

After the independence of Bangladesh, landless and homeless rural people constructed thousands of huts with bamboo mats and plastic sheets near ponds without any planning for sanitation and drinking water. Relief agencies constructed some handpump tubewells in the camps. Another identical group of refugees was sheltered in a camp having piped water and latrines connected to sewers. Although they were supplied with some food by relief agencies, it was not sufficient and they had to work outside the camps.

Epidemic cholera was prevailing over the entire city. We compared hospitalized confirmed cholera cases from 3 major camps (A,B,C) situated a few miles apart. The Redcross and paramedic persons responsible for medical care for the 3 refugee camps supplied the population statistics. The sanitation facilities were checked. The diarrhoea cases requiring I.V. therapy were sent to the Cholera Hospital (CRL) where bacteriological culture of stool was done.

One major and visible difference in the camps was that Camp A had piped water and latrines connected with sewers while camps B and C had hand pump tubewells, ponds and fenced surface latrines. A few of the latrines drained

into the water source. As the refugees were from the same religion, same socioeconomic and same literacy group the influences of other variables were thought to be minimum (see photographs).

RESULTS

The number of water taps and ponds located in the camps are shown in Table 1. In camp A there were 75 taps or 662 people per tap. There was no pond in camp A. There were 1,896 and 2,018 people per tubewell in camps B and C respectively. In camp B, there were 2 ponds, and in camp C 4 ponds. Many people used ponds instead of taps or tubewells for bathing and washing.

The latrines are shown in Table 2. In camp A, there were 382 sewer connected latrines, or one latrine for 130 persons. In camp B, there were however, 35 and in camp C 30 open latrines or 325 persons per latrine in camp B and 405 persons per latrine in camp C. In camps B and C many people also used the banks of ponds and open fields for defecation. Our concern was not however, the number of person per latrine, but the fact that whether stool was passed in surface or in closed latrines.

The population and hospitalised cholera case rates are shown in Table 3. From camp A, there were 80 hospital admissions, from B 45 and from C 52. The case rates per 1000 were 1.6 for camp A, 4.0 for camp B, and 4.3 for camp C. The differences in rates between camps A and B and camps A and C were highly significant (see also Fig. 1).

From the old Dacca municipality, 2,305 confirmed cholera cases were admitted into the CRL (now ICDDR,B) Hospital. The geographic distribution of cholera cases and their rates per 1000 for 1974 and 1975 are shown in Table 4. The overall rate was 1.73 per 1000 in 1974 for the city (see also Fig.2).

During 1975, following the demolition of most of the camps, the overall rate for the city fell to 1.37 per 1000. The rates in Ramna and Mohammadpur units (P.S.), where the camps were mainly located, fell drastically to 0.88 and 0.81 per 1000 from 1.75 and 1.36 of 1974. The differences in reduction were highly significant.

DISCUSSION

In developing countries the rural areas, where there is no water supply or sanitation facilities, have a higher incidence of cholera than do the urban areas. But people living in cities, where there are supplies of safe water and sanitation facilities, also can experience epidemics of cholera as shown

B Camp: Kamalapur Railway-side camp (Bamboo made sheds on the left and right hand sides, not visible). Middle: Some latrines made from bamboo on water source. Foreground: People bathing, swimming and washing.

Camp A: Geneva Camp (Sheds made with bamboo). Background: Some brick-built latrines connected to a sewer. Foreground: People using and collecting piped water.

Camp B: Kamalapur Railway-side camp (Bamboo made sheds on the left and right hand sides, not visible). Middle: Some latrines made from bamboo on water source. Foreground: People bathing, swimming and washing.

TABLE 1

WATER FACILITIES OF REFUGEE CAMPS AND CHOLERA RATES

Camp	Tap/ Tubewell	Person/ Source	Pond/ Tank	Cholera Cases Per 1000
A Geneva Camp	75	662	-	1.61
B Kamalapur Railway Station Camp	6	1,896	2	3.95
C Kataban/Babupara Camp	6	2,018	4	4.29

TABLE 2

LATRINE FACILITIES OF THE 3 CAMPS AND CHOLERA RATES

Camp	Latrine Connected With Sewerage	Persons/ Latrine	Open Surface Latrine	Persons/ Latrine	Cholera Case Rate Per 1000
A Geneva Camp	382	130	-	-	1.61
B Kamalapur Railway Camp	-	-	35	325	3.95
C Kataban/ Babupara Camp	-	-	30	404	4.29

TABLE 3

HOSPITALISATION RATES OF CHOLERA CASES FROM 3 REFUGEE CAMPS IN DACCA CITY IN 1974

Camp	Census Population	No. of Cholera Hospitalized	Hospital Case Rate/1000
A. Geneva Camp	49,675	80[a]	1.61
B. Kamalapur Railway Station Camp	11,375	45[b]	3.95
C. Kataban/Babupara Camp	12,112	52[c]	4.29

a vs b = P < 0.01 Significant

a vs c = P < 0.001 Significant

FIG.1. CHOLERA CASE RATES PER 1,000 IN CAMPS AND IN THE CITY

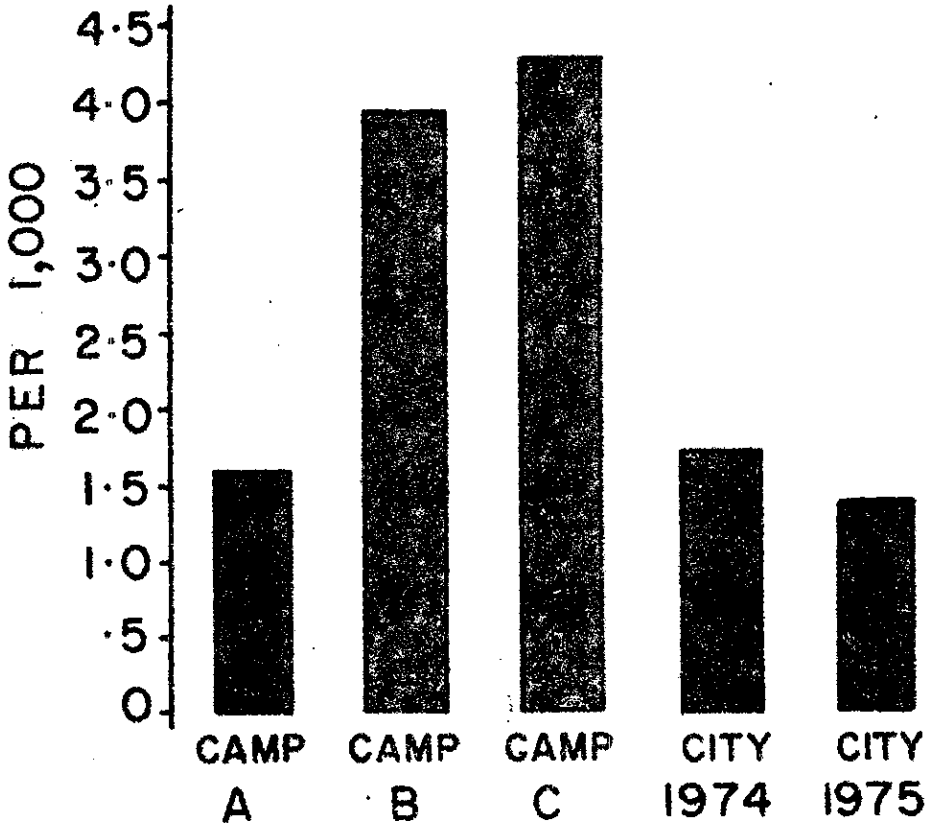


TABLE 4

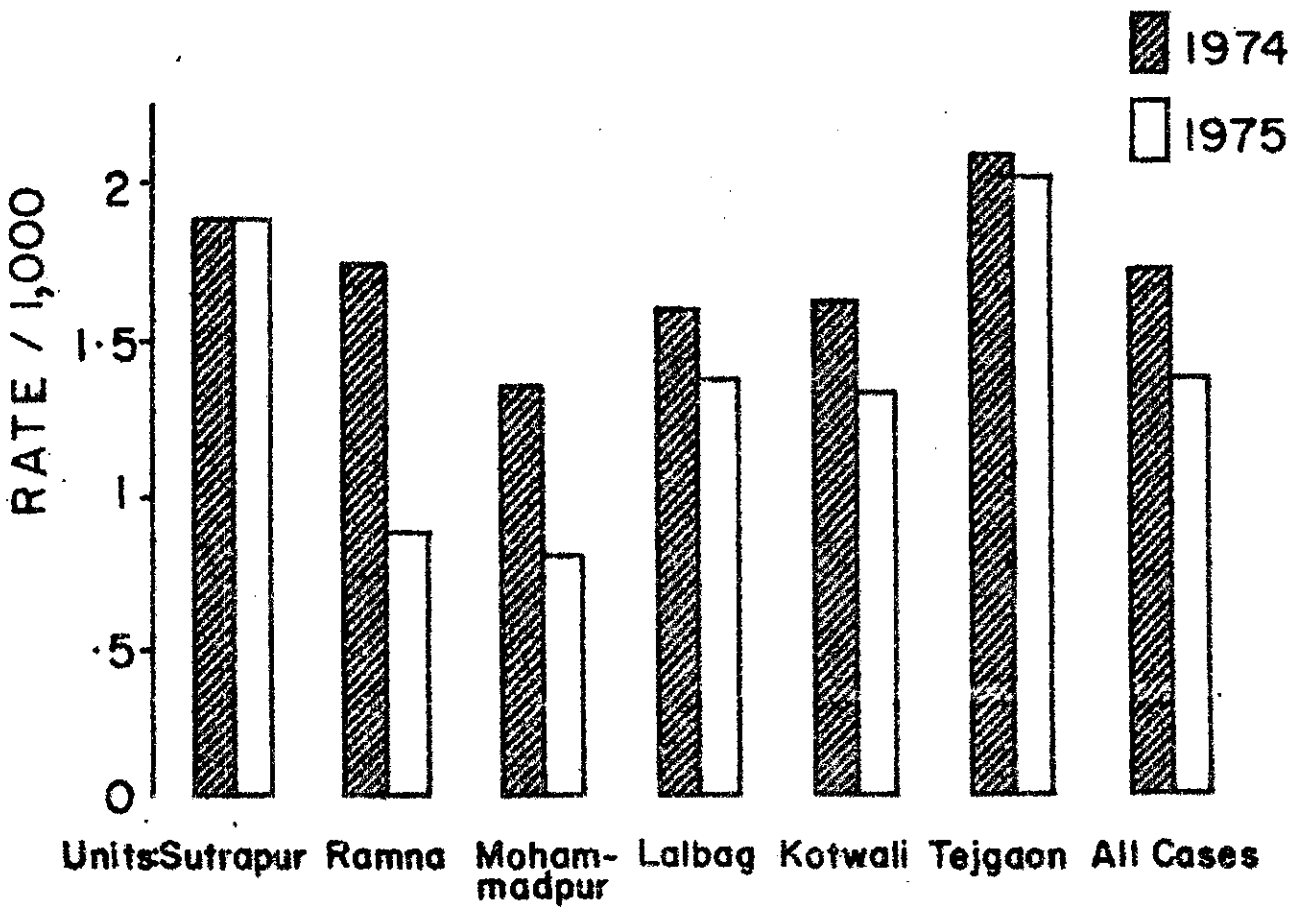
HOSPITALISED CHOLERA RATES IN DACCA CITY BY ADMINISTRATIVE UNITS (POLICE STATIONS) IN 1974 AND 1975

Police Station	1974 Census Population	1974 Cholera Cases No.	1974 Cholera Cases Rate/1000	1975 Cholera Cases No.	1975 Cholera Cases Rate/1000
Sutrapur	218938	420	1.91	417	1.90
Ramna	268363	472[a]	1.75	235[b]	0.88
Mohammadpur	217134	296[c]	1.36	171[d]	0.81
Lalbag	247494	396	1.60	344	1.39
Kotwali	159275	261	1.63	214	1.34
Tejgaon	218103	460	2.10	440	2.02
All Dacca City	1,329307	2305	1.73	1826	1.37

a vs b χ^2 = 79.55 P = <.0001

c vs d χ^2 = 33.49 P = <.0001

FIG.2. GEOGRAPHICAL DISTRIBUTION OF HOSPITALISED CHOLERA CASES IN DACCA CITY DURING 1974 AND 1975 BY ADMINISTRATIVE UNITS



in this study. But why is this so? This study gives some explanation for such epidemics. When rural people come to the city with their traditional habits of defecation and water use, they do not understand the value of sanitation and water quality. These people take refugee in the cheapest rental areas of cities where sanitation and water supply are non-existent. Although they may bring a few jars of drinking water from a distance, they use the nearest water from ponds, tanks, canals or rivers for washing and bathing and these activities can be more important than drinking, for the transmission of cholera (9,14). These open sources can be infected from open latrines, defecation of children on the banks, the washing of soiled cloths, and from dirty surface water, especially after rain. The question arises then, why do not all people who use open sources of water get cholera? The first reason is that, it is not likely that bacteria would remain viable and infective in water indefinitely; second, it is unlikely that the concentration of bacteria would be adequate to achieve infective doses in users of infected water and third, it has been shown that in endemic countries there is a rise of vibriocidal titres with the increase in age and this has a protective effect (16). To explain cholera in camp A we had to examine the exact nature of the water supply, latrine conditions, the sewerage disposal systems and hygienic condition of the camp A. These were far from ideal. Many young children were defecating outside the latrines. They touched the unprotected taps, their own water containers, and food. The people who worked in the city, where the epidemic was present, took their mid-day meal often outside homes and thus could have been exposed to contaminated food and drink (17). In addition, they often brought vegetables, fish, fruits and prepared food from city areas. These created an opportunity for the introduction of cholera into their families and to the camp, in spite of having protected water and sanitation facilities.

However, the imperfect sanitation and water supply facilities reduced the cholera rates by 62% in the camp A as compared to camps B and C. The demolition of the camps and latrines and the curtailment of the use of surface water significantly reduced the rates in the following year especially in the two zones where these camps were located. Although we do not consider that the camps were solely responsible for cholera, but they were acting as nuclei for the spread of cholera in their vicinity.

The 4th grade Government employees living in the government quarters with provision of sanitary latrines and piped water supply experienced cholera frequently. Whereas the upper grade employees, living in government quarters with provision of sanitary latrines and piped water supply, never contracted cholera. Similarly the people living in the top class residential areas of Dacca never contracted cholera in the midst of most severe epidemics of cholera. The main difference between the upper and lower groups were in the practices of personal and food hygiene. Azurin found that the combined effect of water supply and sanitation, in reducing cholera, is up to 76% (18). This shows that in addition to provision of water and latrine there are one or more components which influence the rate of cholera in developing countries.

Therefore, epidemic cholera cannot be adequately prevented in the congested urban setting of a developing country by the provision of clean water or sanitation, or both while keeping other routes open. We conclude that (1) the users of closed latrines and piped water have a significantly lower evidence of cholera than do the users of open latrines and open water sources; and (2) for achieving the proper impact of sanitation on diarrhoeal disease, especially cholera, health education is an important determinant.

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