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TRANSACTIONS OF THE ROYAL SOCIETY OF TROPICAL MEDICINE AND HYGIENE, VOL. 76, NO. 3, 1982

Role of water and sanitation in the incidence of cholera in refugee camps

MOSLEM UDDIN KHAN AND MD. SHAHIDULLAH

International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR, B), G.P.O. Box 128, Dacca-2, Bangladesh

Summary

The purpose of this study was to determine the prevalence of cholera in two groups: (i) people using covered latrine and piped water; (ii) people using uncovered surface latrine and pond and tubewell water. The study population consisted of cholera cases admitted to the ICDDR, B hospital from three refugee camps. In the one camp with sanitation facilities, the cholera rate was 1·6 per 1,000, whereas in the two camps without facilities the rates were 4·0 and 4·3 per 1,000. Following demolition of the camps, the cholera rates decreased significantly in the camps' geographical zones. Cholera was not totally eliminated, even in the one camp with sanitation facilities, suggesting that health education, as well as proper sanitation, is necessary to eradicate cholera.

Introduction

John Snow was the first to observe transmission of the cholera agent through water (SNOW, 1855). Since his time many workers have documented the transmission of cholera bacteria from stool to water and back to man. Various authors have shown that epidemics of cholera were due to transmission of *Vibrio cholerae* through open water sources in India (MATHEW, 1949; BENJAMIN, 1949) and Bangladesh (MOSLEY, 1965-66; HUGHES, 1977; KHAN & MOSLEY, 1967; SOMMER & WOODWARD, 1972; SPIRA *et al.*, 1980). But VAN DE LINDE & FORBES (1965) from Hongkong, SINHA *et al.* (1967) from India and BART *et al.* (1970) from Bangladesh have traced cholera epidemics to the isolation of *V. cholerae* from night-soil. In many developing areas people contaminate ponds, canals and rivers by passing stools on their banks and also by washing the anus after defaecation 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 (LEVINE *et al.*, 1976; KHAN *et al.*, 1978; CURLIN *et al.*, 1977).

In order to elucidate the possible roles in cholera transmission of open uncovered latrines without pit, and the use of pond water, compared to covered latrines and chlorinated pipe water, we followed the incidences of cholera in three major refugee camps during the cholera epidemics in Dacca in 1974 and 1975. The population census of 1974 was used for rates in other zones.

Materials and Methods

After the independence of Bangladesh in 1971, 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 hospital in-patient confirmed cholera cases from three major camps (A, B, C) situated a few miles apart. The Red Cross and paramedical personnel, responsible for medical care for the three refugee camps, supplied the population statistics. The diarrhoea cases requiring i.v. therapy were sent to the Cholera Hospital (ICDDR) where bacteriological stool culture was done. Camp B was about five miles and camps C and A about four miles distant from the Hospital. Transport was most easily available from camp A and C. Transport for camp B was available at 8 to 10 min walking distance away.

One major and visible difference in the camps was that camp A had chlorinated piped water and brick built latrines connected with sewers (Fig. 1) whereas camps B and C had hand pump tubewells, shallow ponds and fenced surface latrines without covering or pit underneath. A few of the latrines were constructed on the bank of the water source which was used for washing and bathing (Fig. 2). As the refugees were from the same religion, low socio-economic and low literacy groups the influences of other variables were thought to be minimum.

Results

The number of water taps and ponds located in the camps are shown in Table I. In camp A there were 75 taps or 662 people per tap. There was no pond in camp A. There were 1896 and 2018 people per tubewell (handpump) in camps B and C respectively. There were two ponds in camp B and four in camp C. Many people used ponds instead of taps or tubewells for bathing and washing.

The latrines are shown in Table II. 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, uncovered fenced 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 defaecation. Our concern was not, however, the number of persons per latrine, but the question whether stools were passed on open surfaces or in closed latrines.

The population and cholera case rates in hospital are shown in Table III. There were 80 hospital admissions from camp A, 45 from B and 52 from C. 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.

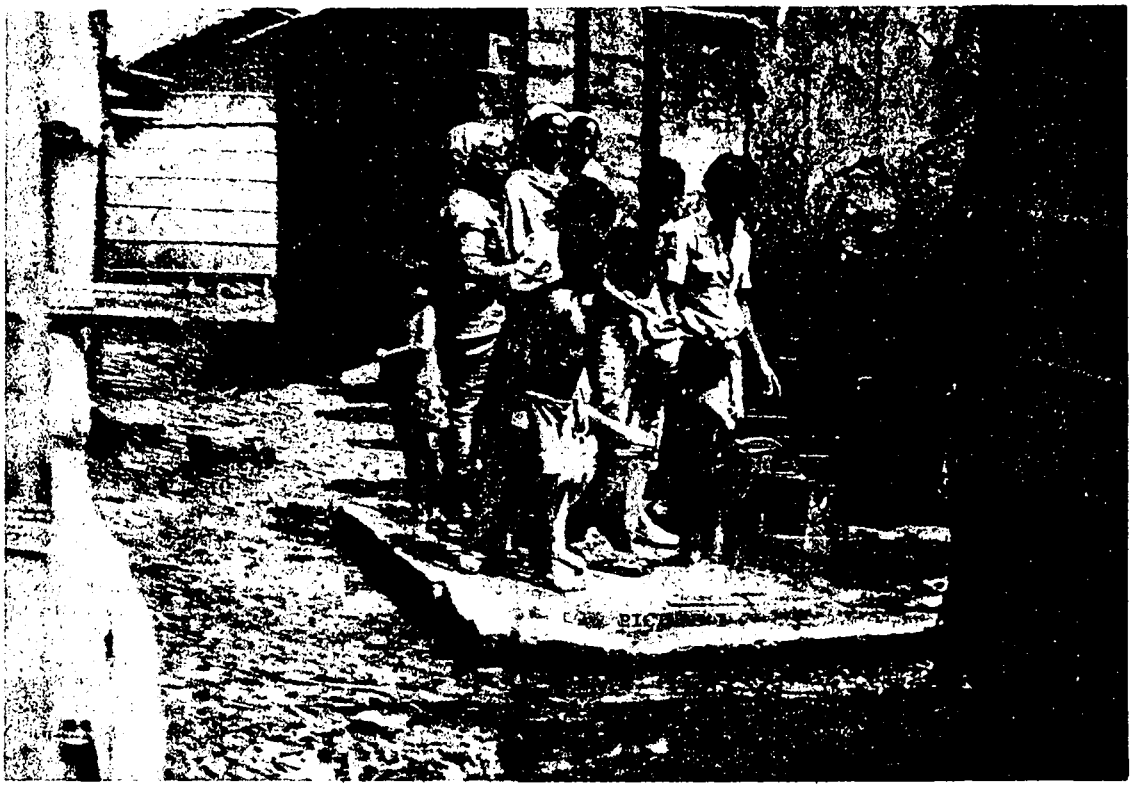

Fig. 1. Chlorinated piped water and brick built latrines connected to sewers.

Fig. 2. Latrines constructed on bank of water source used for washing and bathing.

Table I—Water facilities of refugee camps, 1974

	Camp	Water Tap[1]/ Tubewell	No. of persons/water source	Water Pond[2]/ Tank
A.	Mohammadpur Camp	75	662	—
B.	Kamalapur Railway Station Camp	6	1896	2
tC.	Kataban/Babupara Camp	6	2018	4

[1]Tap = municipal water supply with stopcock
[2]Pond = ditches dug out of earth and used as reservoirs for water

Table II—Latrine facilities of the 3 camps, 1974

	Camp	Latrine connected with sewerage	No. of persons/ latrine	Open surface latrine	No. of persons/ latrine
A.	Mohammadpur Camp	382	130	—	—
B.	Kamalapur Railway Station Camp	—	—	35	325
C.	Kataban/Babupara Camp	—	—	30	404

Table III—Hospital in-patient cholera cases from three refugee camps in Dacca city in 1974

	Camp	Census Population	No. of cholera cases in hospital	Hospital case Rate/1000
A.	Mohammadpur 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

P of (a) v. (b) = <·01
P of (a) v. (c) = <·01

Table IV—Hospital in-patient 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	218,938	420	1·91	417	1·90
Ramna	268,363	472(a)	*1·75*	235(b)	*0·88*
Mohammadpur	217,134	296(c)	*1·36*	171(d)	*0·81*
Lalbagh	247,494	396	1·60	344	1·39
Kotwali	159,275	261	1·63	214	1·34
Tejgaon	218,103	460	2·10	440	2·02
Gulshan	185,289	79	0·42	77	0·41
Mirpur	162,954	182	1·12	205	1·25
All Dacca city	1,677,550	2,566	1·52	2,108	1·25

(a) v. (b) $\chi^2 = 79{\cdot}55$ p = <·0001
(c) v. (d) $\chi^2 = 33{\cdot}49$ p = <·0001

From the old Dacca municipality, 2305 confirmed cholera cases were admitted into the ICDDR,B Hospital. The geographical distribution of cholera cases and their rates per 1000 for 1974 and 1975 are shown in Table IV. The over-all rate was 1·73 per 1000 in 1974 for the city.

During 1975, following the demolition of some of the camps, the over-all rate for the city fell to 1·25 per 1000. The rates in Ramna and Mohammadpur units (P.S.), where the camps were mainly located, fell drastically from 1·75 to 0·88 and from 1·36 to 0·81 per 1000 from 1·75 and 1·36. The differences in reduction (from 1974 to 1975) 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 in this study. This study gives some explanation for such epidemics. When rural people come to the city with their traditional habits of defaecation and water use, they do not understand the value of sanitation and water quality. These people take refuge in the cheapest rental areas of cities where sanitation and water supply are almost 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 (SPIRA *et al.*, 1980; KHAN *et al.*, 1978). These open sources can be infected from uncovered surface latrines, defaecation by children on the banks, washing of soiled cloths and from dirty surface water, especially after rain. It has been shown that in endemic countries there is a rise of vibriocidal titres with increase in age and this has some protective effect (MOSLEY *et al.*, 1968). To explain cholera in camp A we had to examine the exact nature of the water supply, latrine conditions, the sewerage disposal systems and the hygienic condition of the camp. These were far from ideal. Many young children were defaecating 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, often took their mid-day meal outside homes and thus could have been exposed to contaminated food and drink (KHAN & CURLIN, 1977). 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 sanitation and water supply facilities, even with their shortcomings, reduced the cholera rates by 62% in camp A as compared to camps B and C. The demolition of camps B and C and the open latrines, and the curtailment of the use of surface water from early 1975, significantly reduced the rates in 1975, especially in the two zones where these camps were located. Although we do not consider that the camps were solely responsible for cholera, they were acting as nuclei for the spread of cholera in their vicinity.

The fourth grade Goverment employees living in government quarters provided with sanitary latrines and a piped water supply experienced cholera frequently, whereas the upper grade employees, living in government quarters provided with sanitary latrines and piped water supply, almost never contracted cholera. Similarly, the people living in the top class residential areas of Dacca never contracted cholera in the midst of even the most severe epidemics. The main difference between the upper and lower groups were in the practices of personal and food hygiene. AZURINE & ALVERO (1974) found that the combined effect of water supply and sanitation in reducing cholera is up to 76%. This shows that, in addition to the provision of water and latrines, there are one or more components which influence the rate of cholera in developing countries.

Therefore, epidemic cholera may not be adequately prevented in the congested urban setting of a developing country by the provision of clean water or sanitation, or both, while other routes remain open. As has been proved in the past, we may confirm that (i) 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 (ii) that to achieve the proper impact of sanitation on diarrhoeal disease, especially cholera, health education appears to be one of the important factors.

Acknowledgements

We are grateful to Dr. T. Butler, Dr. A. R. Samadi and Dr. Sara Kramer for their kind revision and suggestions in preparing this manuscript. We are also thankful to Dr. W. B. Greenough III, Director, ICDDR,B for encouraging publication of the data.

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Accepted for publication 3rd October, 1981.