*Bull. Org. mond. Santé*
*Bull. Wld Hlth Org.* } 1965, 32, 205-209

# Cholera in East Pakistan Families, 1962-63 *

PAKISTAN-SEATO CHOLERA RESEARCH LABORATORY [1]

*The families of 85 cholera patients hospitalized during 1962-63 in Dacca District, East Pakistan, were studied in order to determine the relationship between familial and individual characteristics and the spread of the disease. Details of the circumstances, personal characteristics and medical history of the family members were recorded, and daily visits were made over a two-week period by a team of physicians and sociologists. Secondary cases were observed in 33 of the 85 families. Secondary attack rates were higher among children than adults. Spread of cholera within these families was suggested by the distribution of intervals between primary and subsequent cases, by the relationship between lengthy home stay of index cases and increased numbers of secondary cases, and by the effect of family structure on secondary attack rates.*

The endemic and epidemic pattern of cholera in Bengal is well known (Pollitzer, 1959); however, the precise manner in which cholera is spread and the disease perpetuated is not clear.

Since little is known about the behaviour of cholera in specific subgroups of the population, such as families, studies of spread of infection in families of cholera patients in the Dacca District of East Pakistan were begun in 1962. This report describes the epidemiological features of multiple cases occurring in a group of 85 families of patients hospitalized with bacteriologically confirmed cholera. Fifty-seven secondary cholera cases were observed in 33 of the 85 households. The present study provided an opportunity to examine the relationship between familial and individual characteristics and the likelihood of occurrence of multiple cases within households.

## METHOD

Families located within a 10-mile (16-km) radius of Dacca were selected for study, usually within two days of hospitalization of a family member with bacteriologically proven cholera. Families were defined as units consisting of two or more individuals who lived and dined together. Members were not necessarily related by blood. Cholera was defined as an acute diarrhoeal disease associated with the recovery of *V. cholerae* (Inaba or Ogawa) organisms from faeces within five days of the onset of symptoms. Six families were also included from the index cases of which cultures were not obtained; these were families in which rapidly fatal cases occurred followed by one or more bacteriologically proven cases.

The families were visited at daily intervals, excluding weekends, for at least two weeks by teams comprising physicians and sociologists. On the initial visits, questionnaires were completed to provide the following information about the families: location and type of housing, religion, travel away from home, recent contact with diarrhoea and cholera cases, and past cholera experience. Individual characteristics such as age, sex, marital status, and occupation were recorded. At each visit, inquiry was made concerning the health of every family member. Whenever diarrhoea or vomiting was reported, a rectal swab was obtained for bacteriological investigation, and clinical details of the illness were recorded. The rectal swabs were placed in bile peptone transport media and incubated overnight at 37°C. Subcultures were made on gelatin agar and Monsur's bile peptone tellurite medium and incubated overnight at 37°C. Suspicious colonies were tested for agglutination with specific antisera.

* This work was supported in part by Research Agreement No. 196802 between the National Institutes of Health, Bethesda, Md., USA, and the Pakistan-SEATO Cholera Research Laboratory.

[1] Dacca, East Pakistan. Those who took part in the study were: Q. M. Asadullah Akef, M.A.; Jahanara Akhter, M.A.; B. I. Davies, M.B.,B.S.; Md. A. Islam, M.B.,B.S.; Syed Ahmed Khan, M.A.; A. Q. Khan, M.B.,B.S., Dipl. P.H., M.P.H.; A. S. M. M. Rahman, M.B.,B.S.; J. L. Stockard, M.D., M.P.H., and R. Oseasohn, M.D.

TABLE 1
DISTRIBUTION OF FAMILIES BY THE NUMBER OF CHOLERA CASES (INDEX AND SECONDARY)

| Number of cases per family | Number of families |
|---|---|
| 1 | 52 |
| 2 | 24 |
| 3 | 4 |
| 4 | 2 |
| 5 | 1 |
| 6 | 1 |
| 11 | 1 |
| Total | 85 |

## RESULTS

The study was performed from late October 1962 through June 1963. Subsequent cases of cholera developed in 33 of the 85 families during the two-week observation periods. The frequency distribution of the number of affected individuals in families is shown in Table 1.

The intervals between the onset of illness in index cases and the appearance of the 57 subsequent cases in families are shown in Table 2. Thirteen contacts developed cholera on the same day in which symptoms appeared in the 85 index cases. These 13 cases, and possibly the 23 other illnesses occurring within three days of the onset of disease in index cases, may represent spread from a common source, infection from contact with primary cases, or a combination of both. " True secondary cases " cannot be identified precisely among multiple illnesses occurring in families, since the source of infection is difficult to prove, and incubation periods in cholera may vary from a few hours to several days. However, " secondary cases ", as defined in this study, provide an estimate of risk among family members.

The majority of secondary cases developed within four days. A few continued to appear each day thereafter. In six instances, intervals exceeded seven days. The occurrence of secondary cases was not related to age or sex of index cases. Secondary attack rates are shown in Table 3. The number of affected persons below 15 years of age was significantly higher than that for adults ($P < 0.01$). There was no significant difference in secondary attack rates by sex.

The average family size was 6.1 individuals per family in the 52 households without subsequent cases, and 8.5 in the 33 multiple-case families. The effect of family size and structure on the proportion of families with secondary cases and on secondary attack rates is shown in Tables 4 and 5. Secondary attack rates were observed to be higher, both among children under 15 years of age and adults, in families with six or more members than in those with less than six members.

The relationship between the interval from onset of illness in index cases to removal from the household and the occurrence of multiple cases was examined (Table 6). Secondary attack rates were significantly higher in those families exposed to index cases for longer than 12 hours than in families exposed for less than 12 hours. The effect of the length of exposure on the secondary attack rate was also demonstrable when family structure (the number of persons under 15 years) was held constant ($P < 0.05$).

## DISCUSSION

Several findings in the present study suggest that spread within families did occur. Cholera continued

TABLE 2
INTERVALS BETWEEN ONSET OF ILLNESS IN FIRST CASES AND APPEARANCE OF SUBSEQUENT CASES IN FAMILIES

| Subsequent cases | Intervals in days | | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| Daily total | 13 | 9 | 8 | 6 | 8 | 3 | 3 | 1 | 3 | — | 3 | 57 |
| Cumulative total | 13 | 22 | 30 | 36 | 44 | 47 | 50 | 51 | 54 | 54 | 57 | 57 |

TABLE 3
AGE AND SEX DISTRIBUTION OF INDEX CASES, SECONDARY CASES AND POPULATION AT RISK IN FAMILIES

| | Age-group (years) | | | | | | | | Unknown | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0-4 | | 5-9 | | 10-14 | | 15+ | | | |
| | M | F | M | F | M | F | M | F | | |
| Index cases | 18 | 9 | 3 | 14 | 7 | 4 | 8 | 19 | 3 | 85 |
| Family members at risk | 42 | 47 | 50 | 46 | 34 | 39 | 134 | 121 | 4 | 517 |
| Secondary cases [a] | 10 | 8 | 9 | 8 | 6 | 5 | 6 | 5 | — | 57 |
| Secondary attack rate [a] | 23.8 | 17.0 | 18.0 | 17.4 | 17.6 | 12.8 | 4.5 | 4.1 | — | 11.1 |

[a] Secondary cases, as defined here, may represent infection from contact with primary cases, or spread from a common source of infection, or a combination of both. The secondary attack rates must be understood in this sense.

to appear in family contacts up to ten days following primary cases. An increase in secondary illness was associated with prolonged household contact with index cases before hospitalization. The relationship between secondary rates in families and the number of children below 15 years of age is consistent with intrafamilial spread in a crowded setting. Multiple introductions cannot, however, be excluded.

The frequent occurrence of multiple cases of cholera in households was described during the last century in the United Kingdom by Snow (1855) and by Budd (1883). Recently, Morgan et al. (1960) in Thailand and Dizon et al. (1963) in the Philippines reported that multiple illnesses in the same family were uncommon. However, comparison of secondary attack rates in different studies is hazardous owing to variations in the methods of morbidity data collection.

High incidence rates among children would be expected in a densely populated country in which cholera is a disease of continued high prevalence. Snow stated that " where a whole family live, sleep, cook, eat and wash in a single room . . . cholera has been found to spread when once introduced."

TABLE 4
FAMILY SIZE AND PROPORTION OF FAMILIES WITH SECONDARY CASES AND SECONDARY ATTACK RATES IN CHILDREN AND ADULTS

| No. of individuals in family | Proportion of families with secondary cases [a] | Age-group | | | | Total Proportion affected [b] | Secondary attack rates [a] |
|---|---|---|---|---|---|---|---|
| | | Under 15 years | | 15 years or more | | | |
| | | Proportion affected [b] | % affected | Proportion affected [b] | % affected | | |
| 2-5 | 8/37 | 7/48 | 14.6 | 1/70 | 1.4 | 8/118 [c] | 6.8 |
| 6-9 | 14/32 | 15/102 | 14.7 | 7/98 | 7.1 | 22/200 | 11.0 |
| 10 or more | 11/16 | 24/110 | 21.8 | 3/87 | 3.4 | 27/197 | 13.7 |
| Total | 33/85 | 46/260 | 17.7 | 11/255 | 4.3 | 57/515 | 11.1 |

[a] Secondary cases as defined here may represent infection from contact with primary cases, or spread from a common source of infection, or a combination of both. The secondary attack rates must be understood in this sense.

[b] No. of persons affected/No. at risk.

[c] Ages of two persons unknown.

TABLE 5

FAMILY STRUCTURE AND PROPORTION OF FAMILIES WITH SECONDARY CASES AND SECONDARY ATTACK RATES IN FAMILIES

| Number of persons under 15 years in families | Proportion of famiiies with secondary cases [a] | Age-group | | | | | Secondary attack rates [a] (%) |
|---|---|---|---|---|---|---|---|
| | | Under 15 years | | 15 years or more | | Total [b] | |
| | | Proportion affected [b] | % affected | Proportion affected [b] | % affected | | |
| 0 | 0/2 | 0/0 | — | 0/5 | — | 0/5 | — |
| 1-2 | 8/28 | 7/29 | 24.1 | 1/66 | 1.5 | 8/95 | 8.4 |
| 3-4 | 9/28 | 8/73 | 11.0 | 6/76 | 7.9 | 14/149 | 9.4 |
| 5-6 | 7/15 | 11/69 | 15.9 | 1/55 | 1.8 | 12/124 | 9.7 |
| 7 or more | 9/11 | 20/89 | 22.5 | 3/53 | 5.7 | 23/142 | 16.2 |
| Total | 33/84 [c] | 46/260 | 17.7 | 11/255 | 4.3 | 57/515 [c] | 11.1 |

[a] Secondary cases as defined here may represent infection from contact with primary cases, or spread from a common source of infection, or a combination of both. The secondary attack rates must be understood in this sense.

[b] No. of persons affected/No. at risk.

[c] Age of two persons in one family unknown.

TABLE 6

NUMBER ATTACKED/NUMBER AT RISK BY FAMILY STRUCTURE AND INTERVAL BETWEEN ONSET OF ILLNESS IN INDEX CASES TO REMOVAL FROM HOUSEHOLD

| No. of persons under 15 years in families | Time interval | | |
|---|---|---|---|
| | Less than 12 hours [a] | 12 hours or more [a] | Total [a] |
| 0 | 0/1 | 0/4 | 0/5 |
| 1-2 | 1/40 | 7/55 | 8/95 |
| 3-4 | 1/77 | 7/62 | 8/139 |
| 5-6 | 10/72 | 2/52 | 12/124 |
| 7 or more | 4/60 | 16/68 | 20/128 |
| Total | 16/250 | 32/241 | 48/491 [b] |

[a] No. of persons affected/No. at risk.

[b] 26/517 persons at risk not classified due to unknown ages and/or intervals.

## ACKNOWLEDGEMENTS

The laboratory acknowledges the contributions of the participating field workers and laboratory technicians, and the statistical advice of G. E. Bartsch, Sc.D., Division of Biometry, Western Reserve University, Cleveland, Ohio, USA.

## RÉSUMÉ

L'influence de certaines caractéristiques individuelles ou familiales sur l'apparition, au sein d'une même famille, de cas multiples de choléra a fait l'objet d'une enquête épidémiologique menée au Pakistan-Oriental.

Les familles de 85 malades hospitalisés pour cette affection ont été suivies pendant au moins deux semaines. Au total, 57 nouveaux cas se sont déclarés chez 33 d'entre elles: 13 le jour même de l'hospitalisation du 1er cas familial, 23 dans les 3 jours, et 21 du 4e au 10e jour. La morbidité secondaire a été plus élevée chez les sujets de moins de 15 ans que chez les adultes, la différence étant significative, et plus élevée également, pour chaque groupe d'âge, dans les familles comptant 6 membres ou plus. Les cas secondaires ont été plus nombreux dans les familles à forte proportion d'enfants de moins de 15 ans.

L'âge et le sexe du premier malade hospitalisé ont été sans influence, mais lorsque le délai entre le début de l'affection et l'hospitalisation a été supérieur à 12 heures, il en est résulté une augmentation statistiquement significative des cas de choléra secondaires.


## REFERENCES


Budd, W., (1883) *Cholera and disinfection: Asiatic cholera in Bristol in 1866*, Bristol

Dizon, J. J., San Juan R. B., Valera, J. P. & Alvero, M. G. (1963) *Cholera El Tor, epidemiologic aspect, Philippines, 1961-1963*, Disease Intelligence Center, Manila

Morgan, F. M., Felsenfeld, O., Rodvatanskul, B., Buspavanich, S., Bandhumedha, B. & Chowvanasai, A. (1960) *Amer. J. Hyg.*, **72**, 250-260

Pollitzer, R. (1959) *Cholera*, Geneva (*World Health Organization: Monograph Series*, No. 43)

Snow, J. (1855) *On the mode of communication of cholera*, 2nd ed., London