

6
PUBLICATION SERVICES SECTION

file copy

TEN YEARS REVIEW OF THE AGE AND SEX OF CHOLERA PATIENTS

Moslemuddin Khan
A. K. M. Jamiul Alam
A.S.M. Mizanur Rahman



CHOLERA RESEARCH LABORATORY

Dacca, Bangladesh

May, 1978

Scientific Report No. 14

TEN YEARS REVIEW OF THE AGE AND SEX OF CHOLERA PATIENTS

Moslemuddin Khan¹
A.K.M. Jamiul Alam²
A.S.M. Mizanur Rahman³

CHOLERA RESEARCH LABORATORY
G.P.O. Box 128, Dacca - 2
Bangladesh

-
- 1 Investigator and Head, Community Studies Branch
2 Chief Physician, Dacca Hospital
3 Chief Physician, Matlab Hospital

PREFACE

The Cholera Research Laboratory (CRL) operates under a bilateral project agreement between the governments of Bangladesh and the United States of America. Research activities of CRL center on the interrelationships between diarrheal disease, nutrition, fertility and their environmental determinants. CRL issues two types of papers: scientific reports and working papers which demonstrate the type of research activity currently in progress at CRL. The views expressed in these papers are those of authors and do not necessarily represent views of Cholera Research Laboratory. They should not be quoted without the permission of the authors.

ABSTRACT

Over a period of 10 years, more than 13,000 cholera cases, both urban and rural Classical and El Tor, have been analysed to determine the age and sex characteristics of cholera patients.

Findings show that over 50% of all cholera occurs in the age group 0-9. Male children contract cholera more often than female children. But females between the ages of 20-39 contract cholera more often than males of the same age group. This trend has been observed during Classical and El Tor periods both in urban and rural areas.

The rates of cholera were not much different in urban and rural areas. The overall rate of cholera on the average was a little over 1 per 1000 per year. This includes some non-cholera years when the rates were very low. The greatest rate (1.7/1000/year) was found during the El Tor epidemic of 1974 and 1975.

INTRODUCTION

In the 1850's, John Snow (1) recognized, that an age and sex difference existed among cholera patients. He observed that during the early part of a cholera epidemic males were more affected than females. Kamal (2) found in his studies in Cairo that while infants and children comprised 13.24% of the population only 4.5% of cholera patients fell into that group while the cholera rate in adults was much higher. Pollitzer (3) maintained that cholera as a rule is most rampant among adults within the age limit of about 20 to 50 years old. Yen (4) observed that the incidence of cholera in young adult males was higher than females. Forbes¹/ postulated that males might contract more infection than females. Dizon (5) had shown that cholera was characteristically a disease of adults over the age of 20. Felsenfeld (6) expressed that all age groups were equally affected in a newly introduced area and females have greater chances of contracting cholera. He thought that sex was not a decisive factor in cholera. McCormack et al., (7) observed that in rural East Pakistan (Bangladesh) the attack rate was over 10 times greater in young children than in adults over 30 years of age. He also maintained that male children were more commonly affected than female children and adult females had higher rates than adult males. Martin et al., (8) found that in urban East Pakistan the incidence of cholera among adults (15 +) was only one half that of children. He further observed that the rates were approximately equal for the sexes. Bart et al., (9) found that 42% of the Inaba Classical patients and 32% of Ogawa El Tor patients were less than 14 years of age. In the 0-4 years age group 12% were El Tor Ogawa cases and 26% were Inaba Classical cases occurring at the same time and in the same society. They further reported that the age and sex distribution among the contacts of both biotypes were similar.

Therefore, it appears that the opinions of various investigators differs probably due to different situations prevailing in the area of investigation. Pollitzer maintained that-evaluation of comparative frequency with which cholera occurs in two sexes and in various age groups is difficult in that (a) the size of the samples of authors varies greatly rendering statistical significance different and (b) most observers merely quote the age and sex incidence of cases without showing the total number of members in those groups. To overcome these difficulties it is essential to have an analysis of large number of cholera cases occurring over a long period of time in an area of known population.

¹/ Forbes, G.I., WHO unpublished Report of Seminar on Cholera Control, Manila, 1964.

The Cholera Research Laboratory (CRL) has treated and isolated the largest number of Classical and El Tor cholera cases which occurred over a period of 13 years both in rural and urban areas having known populations. We have therefore, analysed the data to characterise the age and sex incidence of both Classical and El Tor cholera cases of Dacca and Matlab of Bangladesh.

METHODS

The CRL has been functioning since 1963 both in Dacca and in rural Matlab Bazar Thana (Police Station) of the Comilla district. A field hospital has been established at Matlab to treat all diarrhea cases at the central area of 234 surveillance villages. Eight ambulances have been stationed at different locations for transporting diarrhea patients to the hospital. The village field staff of the CRL encourage all diarrhea cases to attend the CRL for free treatment. Rectal swabs from diarrhea patients are cultured for Vibrio cholerae, in addition to other common enteric pathogens such as Salmonella, Shigella, E.coli using uniform techniques.

The population are kept up-to-date by periodical census and weekly home visits by the CRL staff. The diarrhea cases of the surveillance area attending the hospital are identified by their individual number.

The CRL Hospital of Dacca is the principal center for treatment of all cases of diarrhea and dysentery and no fees are charged for its services. Severe and moderate diarrhea cases are brought here by the people themselves. Cases are also referred by the local people, physicians and by the city hospitals. In addition to municipal areas, patients arrive at the CRL Hospital from all the surrounding areas. The cases are cultured for enteric pathogens (cholera, salmonella, shigella, E.coli and NAG) using the same technique as for Matlab.

The 1970 population of Matlab (134 villages - old area) has been computed based on the census population of 1968^a/ and 1974^b/ and for 1974 the CRL census population of 1974^b/ has been used. The 1970 population of the Dacca municipal area has been estimated from the census population of 1961 (10) and 1974 (11). We have included the confirmed cholera cases from 1966 to 1975 both in Dacca and Matlab.

a/ Cholera Research Laboratory Population Census of Matlab VTS area, 1968.

b/ Cholera Research Laboratory Population Census of Matlab FSA area, 1974.

During the early part of this observation almost all the cholera cases were Classical Inaba though some Classical Ogawa and some El Tor Ogawa were isolated both from Matlab and Dacca. During 1972 the Classical Ogawa rapidly increased and replaced all Classical Inaba, the prevalent type. Later the Classical Ogawa type decreased and Ogawa El Tor cases occurred simultaneously with the Ogawa Classical up to 1973. After this period the Classical Cholera disappeared from both places. The Inaba soon re-appeared in the form of El Tor Inaba during 1974 and they almost equalled El Tor Ogawa during 1975. (El Tor Inaba predominated later.) The sero and biotype changes of Vibrio cholerae took place both in Dacca and Matlab. Though there were unprecedented movements of people from and to Dacca during and after the Liberation War (1971 - 72) the female to male ratio remained the same (1:1.5) as that of 1961.

Depending on the type of Vibrio, the 10 year period has been divided into the classical period, the mixed period and the El Tor period for Dacca. The number of both classical and El Tor cases occurring together in Matlab was not sufficient for separate analysis and a mixed period has not been shown for Matlab separately. The population and the cholera cases of the Dacca municipal area only have been analysed for Dacca. The population of the old vaccine trial area (V.T.S.) consisting of 134 villages and the cases occurring there have been used for the Matlab rural area.

RESULTS

The rates are mean rate per 1000 people per year. Table 1 shows the population of Dacca city. The population census was conducted by the Government in 1961 and 1974. Based on the proportion of census population an adjusted population for 1968-69 and 1972 have been calculated whereas the 1974 census population has been unaltered. There was no marked difference in the age and sex distribution between the 1961 and 1974 census population.

Table 2 shows the age distribution and rates of cholera cases of Dacca city per year per thousand population for classical, mixed and El Tor period. During the classical period the predominant serotype was Inaba and the highest rates occurred in the age groups 0-4 and 5-9. The rates for Ogawa also were higher for children below 10. During the mixed period higher attack rates were observed in children and in the oldest people in the Inaba group. In the Ogawa group there were no marked differences between the attack rates for the various age groups except for children below 10 who had a slightly higher attack rate.

TABLE 1

POPULATION OF DACCA CITY

Age	1961 (Govt. Census)		1968-69 (Adjusted) Classical Period		1972 (Adjusted) Mixed Period		1974 (Govt. Census) El Tor Period	
	Male	Female	Male	Female	Male	Female	Male	Female
0-4	42091	41845	65284	65835	81449	84016	88989	87836
5-9	42410	42026	65981	63994	82319	81667	90399	92080
10-19	65658	45556	110988	86840	138470	110823	164887	139695
20-29	82170	39947	124291	67000	155068	85503	164986	95983
30-39	49464	24055	79767	41335	99519	52750	113277	60567
40-49	27538	14212	47313	24350	59029	31075	71298	35626
50-59	14388	7787	24515	13490	30585	17215	36704	19997
60+	10188	7377	18400	12964	22956	16544	28910	19477
Total	333907	222805	536539	375808	669395	479593	759450	551261

TABLE 2

CHOLERA CASES BY AGE, AND RATES PER 1000/YEAR, DACCA CITY

Age	Classical Period (Jan. '66-Apr. '71)			Mixed Period (May '71-June '73)			El Tor Period (July '73-Dec. '75)		
	Inaba	Ogawa	All	Inaba	Ogawa	All	Inaba	Ogawa	All
0-4	1.14 753	.1 67	1.2 820	.2 65	.8 271	1.0 336	.77 337	2.2 970	3.0 1307
5-9	1.1 696	.1 77	1.2 773	.3 96	1.1 367	1.4 463	.9 414	2.3 1042	3.2 1456
10-19	.5 490	.05 46	.6 536	.12 62	.47 234	.59 296	.4 279	.9 679	1.3 958
20-29	.5 505	.05 44	.6 549	.15 70	.44 213	.59 283	.3 224	.9 618	1.3 842
30-39	.3 201	.06 37	.4 238	.13 39	.39 119	.52 158	.3 124	.8 356	1.1 480
40-49	.3 103	.06 23	.4 126	.04 8	.31 57	.36 65	.2 44	.6 156	.8 200
50-59	.2 43	.05 9	.3 52	.09 9	.45 43	.54 52	.2 30	.6 91	.9 121
60+	.5 63	.04 6	.5 69	.23 18	.49 39	.72 57	.3 39	.8 94	1.1 133
Total	.6 2854	.07 309*	.7 3163	.16 367	.58 1343*	.74 1710	.5 1491	1.2 4006	1.7 5497

*176 El Tor

*214 El Tor

During the El Tor period there was no classical case, despite the fact that the severest epidemic occurred in Dacca during this period. The proportions of age specific cases were not particularly different from the previous period and the children up to 9 again had the highest rate, and the lowest attack rate was observed in the age group 40-59. The Ogawa El Tor predominated during this time.

Table 3 shows the sex distribution of cholera patients of Dacca city for the 10 year period by age. During the classical period, for both serotypes, male children up to age 9 had a higher attack rate than females whereas in the 20-39 age group females had a higher attack rate than males in the corresponding age group.

During the mixed period and the El Tor period the same trends were observed except that the differences between the adult males and females were more distinct.

Table 4 shows the CRL census population of Matlab area for the year 1968 and 1974. Almost the same age and sex distributions were observed in both the populations. Unlike Dacca, where the female to male proportion was 1:1.5 in the Matlab area the ratio was 1:1.03.

Table 5 shows the 'cholera cases of Matlab (134 villages) area by age and rate per 1,000 per year for the classical and El Tor periods. The number of Ogawa Classical was quite low compared to Inaba Classical. In both the Inaba group and the Ogawa the highest attack rate was in children up to age 9.

During the El Tor period both Inaba and Ogawa serotypes were essentially equally prevalent and the rates were identical. During the classical period the rate was slightly higher for the 0-4 year age group. During El Tor period the highest rate was in the 5-9 year age group. With an increase in age the rate decreased like all other groups with a slight rise for people over 60.

Table 6 shows the sex distribution of cholera cases of rural Matlab. The number of Ogawa Classical were fewer during the classical period and sex distribution is not marked.

During the El Tor period in Matlab, the rates of Inaba and Ogawa were identical except for the 20-39 year age group where the rate for males was 1.2 and in females 3.7. The higher combined rate for this period was 2.8 for males and 3.2 for

TABLE 3

SEX DISTRIBUTION OF CHOLERA CASES, Dacca City/1000/Yr., 1966 - 1975

Male (No. & %)							Female (No. & %)					
Classical Period Jan. 66 - Apr. 71		Mixed Period May 71-June 73		El Tor Period July 73-Dec. 75		A G E	Classical Period Jan. 66-Apr. 71		Mixed Period May 71-June 73		El Tor Period July 73-Dec. 75	
INABA	OGAWA	INABA	OGAWA	INABA	OGAWA		INABA	OGAWA	INABA	OGAWA	INABA	OGAWA
0-4	397(1.2)	34(.1)	33(.2)	140(.9)	190(.9)	527(2.4)	356(1.0)	33(.2)	32(.2)	131(.8)	147(.7)	443(2.0)
5-9	390(1.2)	40(.1)	41(.3)	191(1.2)	248(1.0)	594(2.6)	306(1.0)	37(.1)	55(.3)	176(1.0)	166(.7)	448(2.0)
10-19	279(.5)	22(.03)	30(.1)	127(.5)	138(.3)	363(.9)	211(.5)	24(.05)	32(.14)	107(.5)	141(.4)	316(.9)
20-29	219(.4)	22(.03)	28(.1)	84(.3)	64(.2)	175(.4)	286(.9)	22(.1)	42(.3)	129(.8)	160(1.4)	443(4.0)
30-39	88(.2)	22(.05)	14(.07)	58(.3)	35(.1)	116(.4)	113(.5)	15(.07)	25(.2)	61(.6)	89(.6)	240(1.6)
40-49	60(.2)	13(.05)	3(.03)	35(.29)	23(.1)	87(.5)	43(.4)	10(.1)	5(.08)	22(.4)	51(.4)	69(.8)
50-59	24(.2)	7(.05)	3(.03)	18(.35)	16(.2)	44(.5)	19(.3)	2(.02)	6(.2)	25(.7)	14(.3)	37(.7)
60+	36(.4)	4(.04)	16(.3)	18(.4)	25(.3)	48(.7)	27(.4)	2(.03)	2(.06)	21(.6)	14(.28)	46(1.0)
Total	1493(.6)	164*(.06)	168(.13)	701(.52)*	739(.4)	1954(1.0)	1361(.7)	145(.07)*	199(.2)	672(.7)*	762(.6)	2042(1.5)
* 79 El Tor							* 97 El Tor					
* 113 El Tor							* 101 El Tor					

TABLE 4
POPULATION OF MATLAB OLD V.T.S. Area

Age	Classical Period (1966 - 72) CRL Census 1968		El Tor Period (1973 - 75) CRL Census 1974	
	Male	Female	Male	Female
0-4	10036	9677	12209	11643
5-9	10171	9855	9004	8479
10-19	11902	10332	18139	17306
20-29	5815	8123	7866	8731
30-39	6555	5987	6822	7741
40-49	4767	4049	5919	5247
50-59	3016	2784	4011	3410
60+	3571	2742	4083	3428
Total	55833	53569	68053	65985

TABLE 5

CHOLERA CASES BY AGE AND RATES/1000/YEAR

Age	Classical Period (1966 - 1972)			El Tor Period (1973 - 1975)		
	Inaba	Ogawa	All	Inaba	Ogawa	All
0-4	385 (2.8)	33 (.23)	418 (3.0)	132 (1.8)	149 (2.1)	281 (3.9)
5-9	349 (2.5)	34 (.24)	383 (2.7)	171 (3.3)	157 (3.0)	328 (6.3)
10-19	196 (1.3)	23 (.14)	219 (1.4)	125 (1.2)	107 (1.0)	232 (2.2)
20-29	179 (1.8)	28 (.3)	207 (2.1)	74 (1.5)	60 (1.2)	134 (2.7)
30-39	77 (.9)	16 (.2)	93 (1.0)	54 (1.2)	48 (1.1)	102 (2.3)
40-49	40 (.6)	4 (.06)	44 (.7)	34 (1.0)	26 (.8)	60 (1.8)
50-59	22 (.5)	7 (.2)	29 (.7)	17 (.8)	11 (.5)	28 (1.3)
60+	31 (.7)	3 (.06)	34 (.8)	14 (.6)	24 (1.0)	38 (1.7)
Total	1279 (1.7)	148* (.2)	1427 (1.9)	621 (1.5)	580* (1.4)	1203 (3.0)

*51 El Tor

*2 Classical

TABLE 6

SEX DISTRIBUTION OF CHOLERA CASES, MATLAB/1000/Yr., 1966-1975

Male (No. & %)					Female (No. & %)			
Classical Period 1966 - 72		El Tor Period 1973 - 75			Classical Period 1966 - 72		El Tor Period 1973 - 75	
AGE	INABA	OGAWA	INABA	OGAWA	INABA	OGAWA	INABA	OGAWA
0-4	216(3.1)	18(.3)	73(2.0)	78(2.1)	169(2.5)	15(.2)	59(1.7)	71(2.0)
5-9	195(2.7)	19(.3)	92(3.4)	97(3.6)	154(2.2)	15(.2)	79(3.1)	60(2.4)
10-19	103(1.2)	15(.2)	64(1.2)	54(1.0)	93(1.3)	8(.1)	61(1.2)	53(1.0)
20-29	47(1.2)	12(.3)	13(.6)	12(.5)	132(2.3)	16(.3)	61(2.3)	48(1.8)
30-39	26(.6)	4(.1)	12(.6)	14(.7)	51(1.2)	12(.3)	42(1.8)	34(1.5)
40-49	25(.7)	4(.1)	18(1.0)	10(.6)	15(.5)	-	16(1.0)	16(1.0)
50-59	17(.8)	6(.3)	7(.6)	6(1.5)	5(.3)	1(.05)	7(.7)	5(.5)
60+	17(.7)	2(.1)	7(.6)	19(1.6)	14(.7)	1(.05)	7(.7)	5(.5)
Total	646(1.7)	80(.2)*	289(1.4)	290(1.4)*	633(1.7)	68(.2)*	332(1.7)	292(1.5)

* 32
El Tor* 2
Classical* 19
El Tor

females. Including same non-epidemic years the annual rate was a little over 1 per 1000 per year for the 10 year period.

DISCUSSION

Infants and children up to the age of 9 comprises 28.3 per cent of the population. In the same age group there occurred 50.3% of all cases during the period of classical cholera, and 50.2% El Tor cholera during the El Tor period within the Dacca city. In Matlab rural areas where 33.3% of the population is comprised of children up to 9 years of age 56.1% of classical cholera cases and 50.6% of El Tor cholera cases occurred within these age groups during classical and El Tor period respectively. These are quite different from what Kamal (2) found in Cairo. Pollitzer (3) and Dizon (6) reported that cholera is most rampant within the age limit of 20-40. In Dacca we have found 24.5% of cholera cases within the 20-40 age group which comprises 33.8% of population and in Matlab the figures for this age group are 20% of cases in 23% of the population. MacCormack (7) in a 2 year study observed that cholera was 10 times greater in people under 30 than over. We found in Dacca and Matlab rural area that cholera in people under 30 is around 5 times greater than in people over 30. In some areas of limited facilities young adults who are working may get preference in treatment and, as such, the rates of cholera in young adults admitted or treated in the hospital may apparently seem high, though it has not been found in Dacca and Matlab. Within the same socio-economic and environmental conditions the same trend of age distribution of cases has been observed during this 10 year period irrespective of classical and El Tor cholera cases.

The overall attack rates in females both in Dacca city area and in Matlab rural area were higher than males. John Snow (1) observed that during the early part of an epidemic males were more frequently affected than females which might be due to reasons prevalent at that time and place. However, similar to MacCormack (8) we have observed that males are more affected up to the age of 9 both in Dacca and rural Matlab. Our findings differ from Yen (4) and Forbes (5), who found a higher incidence of cholera in young adult males. In the Bangladesh situation the young adult females contracted cholera twice as much as males.

The higher attack rates in male children in this country may be due to more activity and exposure to contaminated objects. The preferential treatment for males may also play a part. The

lower attack rate in adults may be due to repeated exposure to low dose infection in endemic situations and a gradual build up of vibriocidal antibody titer which is much less in children below the age of 10 than in adults (12). The higher attack rates in females from the ages of 20-39 may be due to several factors such as: nursing of sick children, cleaning of the night soil and contaminated clothes and frequent exposure to contaminated surface water used for domestic purposes. It is not known whether the females of the 20-39 years age group may develop weaker immunity than males which might influence the attack rate. The higher incidence in females of the reproductive age groups both in Dacca and Matlab have been observed during the 10 year period. The pattern of age and sex distribution observed in endemic Bangladesh may not apply to any non-endemic situation.

REFERENCES

1. Snow J: On the mode of communication of cholera. 2d ed. London, 1855. Cited in: Pollitzer R: Cholera. Geneva, WHO, 1959:874
2. Kamal AM: Cholera - some epidemiological problems. J Egyp Pub Hlth Assn 26:3-39, 1951. Cited in: Pollitzer R: Cholera. Geneva, WHO, 1959:874
3. Pollitzer R: Cholera. Geneva, WHO, 1959:874
4. Yen CH: A recent study of cholera with reference to outbreak in Taiwan in 1962. Bull WHO 30:811-825, 1964
5. Dizon JJ, Alvero MG, Joseph PR, Tamayo JF, Mosley WH, Handerson DA: Studies of cholera El Tor in the Philippines. I. Characteristics of cholera El Tor in Negros Occidental Province, November 1961 to September 1962. Bull WHO 33:627-636, 1965
6. Felsenfeld O: The cholera problem. St. Louis, Green, 1967:109
7. McCormack WM, Mosley WH, Fahimuddin M, Benenson AS: Endemic cholera in rural East Pakistan. Am J Epid 89(4):400, Apr 69
8. Martin AR, Mosley WH, Sau BB, Ahmed S, Huq I: Epidemiologic analysis of endemic cholera in urban East Pakistan, 1964-1966. Am J Epid 89(5):572-582, May 69
9. Bart KJ, Huq Z, Khan MU, Mosley WH: Seroepidemiologic studies during a simultaneous epidemic of infection with El Tor Ogawa and Classical Inaba Vibrio cholera. J Infect Dis 121:Suppl 121:S17-S27, May 70
10. Pakistan. Census Commission: Population census of Pakistan, 1961. District Census Report. Dacca, 1961:1-33
11. Bangladesh. Census Commission: Bangladesh population census, 1974, Bulletin 2. Dacca, 1974:76
12. Mosley WH: The role of immunity in cholera; a review of epidemiological and serological studies. Tex Rep Biol Med 27:Suppl 27:227-241, Jul 69

CRL publications can be obtained from Publications Unit, Cholera Research Laboratory, G.P.O. Box 128, Dacca - 2, Bangladesh.

List of current publications available:

A. CRL Annual Report 1976

CRL Annual Report 1977

B. Working Paper:

No. 1. The influence of drinking tubewell water on diarrhea rates in Matlab Thana, Bangladesh by George T. Curlin, K.M.A. Aziz and M.R. Khan.

No. 2. Water and the transmission of El Tor cholera in rural Bangladesh by James M. Hughes, John M. Boyce, Richard J. Levine, Moslemuddin Khan and George T. Curlin.

No. 3. Recent trends in fertility and mortality in rural Bangladesh 1966-1975 by A.K.M. Alauddin Chowdhury, George T. Curlin.

No. 4. Assessment of the Matlab Contraceptive Distribution Project - implications for program strategy.

C. Scientific Report:

No. 1. Double round survey on pregnancy and estimate of traditional fertility rates by A.K.M. Alauddin Chowdhury.

No. 2. Pattern of medical care for diarrheal patients in Dacca urban area by Moslemuddin Khan, George T. Curlin and Md. Shahidullah.

No. 3. The effects of nutrition on natural fertility by W. Henry Mosley.

No. 4. Early childhood survivorship related to the subsequent inter-pregnancy interval and outcome of the subsequent pregnancy by Ingrid Swenson.

No. 5. Household distribution of contraceptives in Bangladesh-the rural experience by Atiqur R. Khan, Douglas H. Huber and Makhlisur Rahman.

No. 6. The role of water supply in improving health in poor countries (with special reference to Bangladesh) by John Briscoe.

No. 7. Urban cholera study, 1974 and 1975, Dacca by Moslemuddin Khan, George T. Curlin.

No. 8. Immunological aspects of a cholera toxoid field trial in Bangladesh by George T. Curlin, Richard J. Levine, Ansaruddin Ahmed, K.M.A. Aziz, A.S.M. Mizanur Rahman, Willard F. Verwey.

No. 9. Demographic Surveillance System - Matlab. Volume One. Methods and procedures.

No. 10. Demographic Surveillance System - Matlab. Volume Two. Census, 1974 by Lado T. Ruzicka, A.K.M. Alauddin Chowdhury.

No. 11. Demographic Surveillance System - Matlab. Volume Three. Vital events and migration, 1974 by Lado T. Ruzicka, A.K.M. Alauddin Chowdhury.

No. 12. Demographic Surveillance System - Matlab. Volume Four. Vital events and migration, 1975 by Lado T. Ruzicka, A.K.M. Alauddin Chowdhury.

No. 13. Demographic Surveillance System - Matlab. Volume Five. Vital events, migration, and marriages - 1976 by Lado T. Ruzicka, A.K.M. Alauddin Chowdhury.

D. Special Reprint:

Management of cholera and other acute diarrhoeas in adults and children - World Health Organization.