43

THE 1978 SEX RATIO AT BIRTH

(Appendix to Demographic Surveillance System-Matlab, 1978)

Stan Becker
Mridul K. Chowdhury

INTERNATIONAL CENTRE FOR
DIARRHOEAL DISEASE RESEARCH, BANGLADESH
Dacca, Bangladesh

November 1981

Working Paper No. 24

THE 1978 SEX RATIO AT BIRTH

(Appendix to Demographic Surveillance System-Matlab, 1978)

Stan Becker[1]

Mridul K. Chowdhury[2]

INTERNATIONAL CENTRE FOR
DIARRHOEAL DISEASE RESEARCH, BANGLADESH
G.P.O. Box 128, Dacca 2
Bangladesh

1 Former Associate Scientist

2 Assistant Scientist and
Head, Data Management Branch

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

The 1978 sex-ratio at birth 100.4 for Matlab appears lower than the usual. The analysis concludes that some male births were not reported in the comparison area in 1978. Deaths in the early neonatal period were reported differently in the comparison area than in the MCH-FP area (zero days vs. one day). It is very likely that some male births which died in the first week of life in the comparison area were not reported as either births or deaths. The idea that some live births which died in the first day were misreported as stillbirths is supported by the indirect evidence of a high stillbirth ratio in the comparison area in 1978 but is not supported by the direct test with data available. None of the above apply to any year except 1978 or any area except comparison area.

INTRODUCTION

The sex ratio calculated from the 3028 male and 3016 female live births recorded in the Matlab Demographic Surveillance System in 1978 was 100.4 giving a proportion of male births of .5010. This figure is below the lower limit reported for any country with relatively complete registration (1). It is generally accepted that the sex ratio at birth lies between 103 and 107.

The tabulations which gave these results were checked three times. In addition the counts of births by sex and village from the computer records were checked against the original birth reports and field records to determine the accuracy of the counts. These checks did not uncover any errors in data processing. In this report we consider the various explanations of this phenomenon.

A RANDOM OCCURRENCE

The sex ratio at birth is known to vary between populations and within populations, according to the age and parity of the mother and frequency and timing of intercourse of the couple. The recorded variation in populations with accurate data is between 103 and 107.

Since all the factors which determine the sex of the fetus are not precisely known, the sex of a newborn can be considered a random variable, following a Bernoulli probability distribution with probability p that the sex will be male. In reality, the parameter p is dependent on the age, parity of the mother and the timing of the act of intercourse which led to conception, and other unknown variables. However, for populations as a whole, such as the Matlab surveillance population, p can be assumed to be constant. With this assumption, it is then possible to consider the births for any given year or area in Matlab as a sample from a population with this

underlying parameter p. In addition, regarding the sex determination as an independent event for each pregnancy and assuming that p is not dependent on time or geographical area within the DSS, the observed sex distribution of births for any given year and area can be considered as a random sample from a binomial distribution with parameters n, representing the number of births and p.

Under these assumptions, it is possible to statistically test if the observed sex ratio of 100 in 1978 is consistent with estimates derived from data for other years in the DSS. To do this the sexes of live births in the DSS area from 1974 to 1977 were tabulated. (1974 is generally agreed to be the year when the surveillance system reached a high level of completeness and accuracy.) These data are shown in Table I. The overall sex ratio for the years 1974-77 was 105 giving a value of p of .5115. Taking this as a constant value for Matlab, the one-way test of the 1978 proportion yields a P value of .103; i.e. the chances of observing a sample with a sex ratio of 100 or less, or, 110 or more in a population with an actual sex ratio of 105 are 1 in 10.

This result can be interpreted two ways: On the one hand, since the probability of the occurrence is low and the ratio is out of line with the series of ratios for previous years it leads one to consider possible non-random explanations for the occurrence. On the other hand, the difference is not insignificant at the customary .05 level.

NON-RANDOM POSSIBILITIES

In 1978, fairly major changes occurred in the DSS. The size of the registration area was changed and the primary data collection personnel were changed. These changes may have had an affect on the quality of the data collected. A second possible non-random explanation is that there were errors in the data processing of the field data. These two possibilities are considered below.

TABLE I--NUMBER OF BIRTHS RECORDED IN DSS AREA, 1974-1978 BY YEAR, SEX AND PROPORTIONS MALE AND SEX RATIO AT BIRTH

Year	Sexes			Proportion Male	Sex Ratios
	Both	Male	Female		
1974-1977	42690	21834	20856	.511	104.7
1974	11315	5756	5559	.509	103.5
1975	7622	3923	3699	.515	106.1
1976	11268	5764	5504	.512	104.7
1977	12485	6391	6094	.512	104.9
1978	6044	3028	3016	.501	100.4

Data Processing Errors

Live births are recorded in the notebook of the worker responsible for primary data collection. During the monthly visit of the male field assistant, these events are recorded on standard birth report forms. The forms are brought to the Matlab office and the events are entered in the Matlab census volume and the birth registry-book. Then periodically the forms are sent to Dacca where they are coded, punched and verified. After punching, the records are listed sequentially by computer and the list is checked for duplicates and then sent to Matlab for further checking. After these procedures the punch cards are sorted to prepare the tabulations by sex, age of mother, etc.

To check for errors which may have entered in these data processing steps, the following were done. First, the cards were sorted twice to guarantee the accuracy of the tabulation. No errors were found. Second, the birth events by sex were counted from the original records. No error was found. Third, the counts of birth events by village, sex and type of outcome were printed for the year 1978. These were checked with the same tabulations done by hand from the Matlab records.

Thus it appears that data processing errors were not the cause of the low sex ratio in 1978.

Data Collection Errors

Since the DSS underwent quite extensive personnel changes in 1978, the possibility of data collection errors needs careful examination. The specific changes are first reviewed and then the possible type of data collection errors are specified and examined with available data.

In October 1977, an MCH-FP programme was begun in 70 villages. In these villages, Female Village Workers, responsible for both the MCH-FP field work and DSS data collection, replaced the dais who previously had collected demographic data. In the remaining villages the dais remained the primary collectors of demographic data. Then in October 1978, the DSS area was reduced to 149 villages. Simultaneously in the non-MCH/FP villages ('comparison' villages) 30 FVWs replaced the dais in the demographic data collection. In both areas, the Field Assistants remained as supervisors of the work. As the FVWs in the MCH-FP area had many duties besides demographic data collection, the frequency of visiting of households was not the same as in the comparison area. In the former, an FVW visits 1000 households on a fortnightly basis while in the latter an FVW visits 3000 households on a weekly basis.

All these factors might lead us to expect differences in coverage of births by area and time (January-September 1978, October-December 1978). Table II shows that such differential reporting did exist. In the MCH-FP area, the sex ratio was at an acceptable level and quite constant for the whole year. In the comparison area the sex ratio was below the normal range in the first part of the year while the dais were working. Then in the period October - December when FVWs began their work in the comparison area, the ratio fell further below acceptable levels. Because of small sample sizes when cross-classifying by area and period, the observed differences

TABLE II--SEX RATIO AT BIRTH IN MATLAB DSS 1978 BY AREA AND TIME PERIOD

Area	Time Period		
	Jan. - Dec.	Jan. - Sept.	Oct. - Dec
Both areas:			
Sex ratio	100.4	101.5	98.4
Number of births	6044	3947	2097
MCH - FP:			
Sex ratio	103.6	103.3	104.0
Number of births	2856	1946	910
Comparison:			
Sex ratio	97.6	99.7	94.3
Number of births	3188	2001	1187

in Table II are not statistically significant. Nevertheless, if we compare the proportion male for the comparison area in 1978 with the proportion for the whole DSS for the years 1974-77, the difference is significant at the .05 level.

An abnormally low ratio could arise due to three types of data collection errors. First, if the sex of live births were misreported; second, if male births were missed, and third, if stillbirths were misreported as live births disproportionately for males. Each of these possibilities is considered in turn. It should be noted that any under-enumeration of birth events which was the same for both sexes, would not be detected in any analysis of the sex ratio.

Regarding the first possibility, the misreporting of the sex of live births is very unlikely. How could births be missed? It is unlikely that live births which survived would not be recorded since the field worker would have observed these infants during her next visit. However, it is possible that live births which died in the first minutes, hours or days, were not recorded either as births or deaths. This possibility can be examined indirectly with tabulations from the available 1978 data. Using the data from 1974 to 1977 as the standard, the proportion of recorded deaths which occurred on day 0 are compared in Table III. It is clear (and highly significant statistically) that deaths in the first 24 hours of life

TABLE III--NUMBERS OF EARLY NEONATAL DEATHS RECORDED IN DSS AREA 1974-1978 BY DAY OF DEATHS, YEAR AND AREA, AND PROPORTION OF EARLY NEONATAL DEATHS REPORTED ON DAY ZERO

Year	Area	Day of Death			Proportion on day 0
		0 - 7	0	1 - 7	
1974-1977	DSS	1141	209	932	.183
1974	"	285	31	254	.109
1975	"	175	39	136	.223
1976	"	311	70	241	.225
1977	"	370	69	301	.186
1978	Comparison	166	12	154	.072
	MCH - FP	116	27	89	.233

Z - test for proportion on day 0: Comparison area 1978 Vs 1974-1978 DSS area.

$$Z = \frac{.183 - .072}{\sqrt{\frac{1}{166}(.183)(.817)}} = 3.69 \quad (P<.001)$$

were disproportionately not reported as such in the comparison area in 1978. This may have easily resulted from a misunderstanding on the part of the new workers that any deaths within 24 hours of birth are recorded as occurring on day zero. Indeed, it can be seen in the last column of Table IV that many of these deaths were apparently reported as occurring on day 1. Nevertheless, it is clear from the tables that the data recording procedures were different in the two areas in 1978.

Considering the sex of these deaths, Table V shows that deaths of males in the first week of life in the comparison area in 1978 were significantly lower than expected on the basis of the experience of previous years. The proportion of male early neonatal deaths in the MCH-FP area were also low; however, because the MCH-FP interventions altered neonatal mortality patterns this figure cannot be used as a basis for comparison. Of course, the fact that male births were low would imply, ceteris paribus, that the proportion of male deaths would be lower than usual. Therefore rates are given in Table VI. In both areas in 1978, the rates are much higher than the rates for the 1974-77 period. In addition, in both areas in 1978 the reported female rate is higher than the male rate which is opposite of the pattern for 1974-77. The differential is greatest in the comparison area. These results are consistent with the explanation of missed male early neonatal deaths in the comparison area though a real change in the early neonatal death pattern cannot be ruled out because the same pattern is seen in both the MCH and comparison areas in 1978.

Finally we consider the possibility that some live births were misclassified as stillbirths (Table VII). The stillbirth ratio for the comparison area in 1978 was higher than any ratio in the DSS for the period 1974-77, and higher than the MCH-FP ratio in 1978. The z statistic for difference in stillbirth rates for 1974-77 and the comparison area in 1978 (.0384 and .0533 respectively) is 4.37 giving $P<.0001$. The rates are used for the test because the z test is not strictly valid for ratios which are not proportions. It is possible therefore that some deaths in the first day of life were reported as stillbirths.

TABLE IV--NUMBER OF EARLY NEONATAL DEATHS RECORDED IN DSS AREA, 1974-1978 BY DAY OF DEATH AND AREA

Day of Death		Area and Period			
		DSS area 1974-1977	Both Areas (1978)	MCH-FP (1978)	Comparison (1978)
0 - 7	Number	1141	282	116	166
	Proportion	1.00	1.00	1.00	1.00
0 - 1	Number	462	120	54	66
	Proportion	.405	.426	.466	.398
0	Number	209	39	27	12
	Proportion	.183	.138	.233	.072
1	Number	253	81	27	54
	Proportion	.222	.287	.233	.325
2 - 7	Number	679	162	62	100
	Proportion	.595	.574	.534	.602

TABLE V--NUMBERS OF EARLY NEONATAL DEATHS RECORDED IN MATLAB 1974-1978 BY SEX, AREA AND YEAR

Year	Area	Sexes			Proportion Male
		Both	Male	Female	
1974-1977	DSS	1141	655	486	.574
1974	"	285	168	117	.589
1975	"	175	91	84	.520
1976	"	311	184	127	.592
1977	"	370	212	158	.573
1978	Comparison	166	79	87	.476
	MCH-FP	116	58	58	.500

Z - test for proportion male early neonatal deaths:
Comparison area 1978 vs. 1974-1978 DSS area.

$$Z = \frac{.574 - .476}{\sqrt{\frac{1}{166}(.574)(.426)}} = 2.55 \quad (P<.01)$$

TABLE VI--BIRTHS, EARLY NEONATAL DEATHS AND EARLY NEONATAL DEATH RATES REPORTED IN THE MATLAB DSS 1974-1978 BY PERIOD, AREA AND SEX

Years and Area		Both Sexes			Males			Females		
		Deaths (days 0-7)	Births	Rate	Deaths (days 0-7)	Births	Rate	Deaths (days 0-7)	Births	Rate
1974 - 1977	DSS	1141	42690	.0267	655	21834	.0300	486	20856	.0233
1978	MCH	116	2856	.0406	58	1453	.0399	58	1403	.0413
	Comparison	166	3188	.0521	79	1575	.0502	87	1613	.0539

TABLE VII--STILLBIRTH RATIOS IN THE MATLAB DSS, 1974 - 1978

Year	Area	Stillbirths per 1000 live births
1974 - 1977	DSS	38
1974	"	34
1975	"	33
1976	"	42
1977	"	43
1978	MCH - FP	41
	Comparison	53

To directly examine the possibility of misclassification of male live births followed immediately by death as stillbirths, data from an independent pregnancy history study in the DSS area were used. In 5 villages of the comparison area, 566 detailed pregnancy histories were collected in March 1980. (A scientific report on this study is in preparation). Comparison of reported stillbirths and total losses with the reports of women in the pregnancy history interviews, revealed no such misclassification (Table 8). It should be noted however, that only two stillbirths were available in these data for the five villages.

TABLE VIII--CLASSIFICATION OF 14 STILLBIRTHS OR FETAL LOSSES RECORDED IN THE DSS IN 4 COMPARISON AREA VILLAGES IN 1978 ACCORDING TO PREGNANCY OUTCOME REPORTED BY THE MOTHERS

Report in DSS		Report in Pregnancy History	
Type	Number	Type	Number
Stillbirth	2	Stillbirth	2
Fetal loss	12	Fetal loss	8
		Stillbirth	1
		Missing in pregnancy history	3

AN ACTUAL PHENOMENON

Is it possible that the observed ratio of 100.4 in the comparison area in 1978 indicates that the sex ratio at birth is actually declining?

This supposition can be tested by examining the data for the 1979 calendar year. The data of 7184 live births in 1979 yield sex ratios of 106 in the comparison area and 108 in the MCH-FP area. The 1978 ratio was clearly not an indication of a general decline in the sex ratio at birth.

CONCLUSIONS

The 1978 sex ratio at birth of 100.4 in the DSS area was below the recorded normal level for most human populations and below the level recorded in Matlab in previous years. Since there were major changes in the

surveillance area and staff in 1978, it was hypothesized that problems of data quality may have existed. Indeed, when examined by area, it was found that the sex ratio in the comparison area, where new workers were assigned in late 1978, was only 98.

Direct checks of the available data did not reveal recording or data processing errors. However, indirect checks with the same data indicated that the recording procedures in the comparison area were different from procedures in the MCH-FP area with respect to the recording of deaths in the first days of life. It was hypothesized that births which died in the first hours or day of life may have been missed entirely in this area. Such events may also have been misclassified as stillbirths but the one direct check of this hypothesis revealed no such misclassification.

In contrast to the possibility of data quality problems, the observed sex ratio could be regarded as a random occurrence or as an indication that the sex ratio in Matlab is declining. The latter possibility was ruled out since 1979 data gave a sex ratio of 107. Under assumptions of a binomial distribution, given the number of births and with the probability of male birth fixed at the value calculated from all births in the DSS area 1974-1977, the probability of observing a sex ratio of 100.4 or below in the whole area in 1978 was .051 and the probability of observing a sex ratio of 98 or below in the comparison area in 1978 was .024.

REFERENCES

1. Visaria PM. Sex ratio at birth in territories with a relatively complete registration. Eugenics Quarterly 1967; 14:132-142.

2. Shryock HS, Siegal JS. The methods and materials of demography. Washington, D.C.: U.S. Government Printing Office, 1973.

3. Bourgeois-Pichat MJ. Esai sur la mortalitie bilogique de l' homne. Population 1952; 7:381-394.

ICDDR,B PUBLICATIONS*

A. Annual Report

CRL Annual Report 1976.
CRL Annual Report 1977.
CRL Annual Report 1978.
ICDDR,B Annual Report 1979.
ICDDR,B Annual Report 1980.

B. Working Paper:

No. 1. The influence of drinking tubewell water on diarrhoea rates in Matlab Thana, Bangladesh by George T. Curlin, K.M.A. Aziz, M.R. Khan. Jun 1977 (2nd Rep. Sep 1980). 21 p.

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, George T. Curlin. Dec 1977 (Rep. Mar 1980). 37 p.

No. 3. Recent trends in fertility and mortality in rural Bangladesh 1966-1975 by A.K.M. Alauddin Chowdhury, George T. Curlin. Jan 1978 (Rep. Oct 1979). 14 p.

No. 4. Assessment of the Matlab contraceptive distribution project-implications for program strategy by T. Osteria, Makhlisur Rahman, R. Langsten, Atriqur R. Khan, Douglas B. Huber, W. Henry Mosley. Apr 1978 (Rep. Feb 1981). 25 p.

No. 5. A study of the field worker performance in the Matlab contraceptive distribution project by Makhlisur Rahman, T. Osteria, J. Chakraborty, Douglas B. Huber, W. Henry Mosley. Jul 1978 (Rep. Feb 1981). 17 p.

No. 6. Constraints on use and impact of contraceptives in rural Bangladesh: some preliminary speculations by R. Langsten, J. Chakraborty. Aug 1978 (Rep. Feb 1981). 24 p.

No. 7. The demographic impact of the contraceptive distribution project by T. Osteria, W.H. Mosley, A.I. Chowdhury. Sep 1978. 17 p.

No. 8. Development of milk teeth in rural Meheran children of Bangladesh by Moslemuddin Khan, George T. Curlin. Sep 1978. 23 p.

No. 9. A follow-up survey of sterilization acceptors in Matlab, Bangladesh by Makhlisur Rahman, Douglas Huber, J. Chakraborty. Oct 1978 (Rep. Jul 1980). 31 p.

No. 10. The demographic impact of sterilization in the Matlab village-based MCH-FP program by T. Osteria, S. Bhatia, J. Chakraborty, A.I. Chowdhury. Nov 1978 (Rep. Jun 1980). 23 p.

---

* These listed publications can be obtained from Head, Library and Publication Branch, International Centre for Diarrhoeal Disease Research, Bangladesh, G.P.O. Box 128, Dacca 2, Bangladesh.

No. 11. Parental dependency on children in Matlab, Bangladesh by Makhlisur Rahman. Dec 1978. 28 p.

No. 12. An areal analysis of family planning program performance in rural Bangladesh by T. Osteria, S. Bhatia, A.S.G. Faruque, J. Chakraborty. May 1979. 19 p.

No. 13. The people of Teknaf: births, deaths and migrations (1976-1977) by Mizanur Rahman, M. Mujibur Rahaman, K.M.S. Aziz, Yakub Patwari, M.H. Munshi, M. Shafiqul Islam. May 1979. 46 p.

No. 14. Pilot study of the calendar rhythm method in the Matlab area of Bangladesh by Stan Becker, Rasheda Akhter. Nov 1980. 23 p.

No. 15. Comparison of measures of childbearing patterns by age and parity in Matlab, Bangladesh by Stan Becker, Helen Hiltabidle. Mar 1981. 29 p.

No. 16. Demographic studies in rural Bangladesh--May 1969-April 1970 by A.I. Chowdhury, K.M.A. Aziz, Kashem Shaikh. Apr 1981. 28 p.

No. 17. Demographic studies in rural Bangladesh May 1970-April 1971 by A.I. Chowdhury, K.M.A. Aziz, Kashem Shaikh. Apr 1981. 31 p.

No. 18. Interrelationships among certain socioeconomic variables in a rural population of Bangladesh by M. Shafiqul Islam, Stan Becker. May 1981. 24 p.

No. 19. Effects of diarrhoea on absorption of macronutrients during acute stage and after recovery by Ayesha Molla, Abdul Majid Molla, Shafiqul Alam Sarker, Makhduma Khatoon, M. Mujibur Rahaman. Jun 1981. 25 p.

No. 20. Intake of nutrient during and after recovery from diarrhoea in children by A.M. Molla, Ayesha Molla, S.A. Sarker, M.M. Rahaman. Jun 1981. 31 p.

No. 21. Epidemiologic pattern of diarrhoea caused by non-agglutinating vibrio (NAG) and EF-6 organisms in Dacca by Moslemuddin Khan, M. Shahidullah. Jun 1981. 29 p.

No. 22. Protein-losing enteropathy in diarrhoea: application of α_1-antitrypsin assay by M.A. Wahed, M. Mujibur Rahaman, R.H. Gilman, W.B. Greenough III, S.A. Sarker. Aug 1981. 21 p.

No. 23. The demographic impact of two contraceptive service projects in Matlab thana of Bangladesh: a compendium of findings for the 1975-1980 period by James F. Phillips, Wayne Stinson, Shushum Bhatia, Makhlisur Rahman, J. Chakraborty. Oct 1981. 93 p.

C. Scientific Report:

No. 1. Double round survey on pregnancy and estimate of traditional fertility rates by A.K.M. Alauddin Chowdhury. Jul 1977 (Rep. May 1978). 28 p.

No. 2. Pattern of medical care for diarrheal patients in Dacca urban area by Moslemuddin Khan, George T. Curlin, Md. Shahidullah. Aug 1977 (Rep. Jun 1978). 20 p.

No. 3. The effects of nutrition on natural fertility by W. Henry Mosley. Aug 1977 (2nd Rep. Dec 1980) 25 p.

No. 4. Early childhood survivorship related to the subsequent inter-pregnancy interval and outcome of the subsequent pregnancy by Ingrid Swenson. Aug 1977 (Rep. Apr 1979). 18 p.

No. 5. Household distribution of contraceptives in Bangladesh--the rural experience by Atiqur R. Khan, Douglas H. Huber, Makhlisur Rahman. Sep 1977 (Rep. Dec 1979). 19 p.

No. 6. The role of water supply in improving health in poor countries (with special reference to Bangladesh) by John Briscoe. Sep 1977 (Rep. Feb 1979). 37 p.

No. 7. Urban cholera study, 1974 and 1975, Dacca by Moslemuddin Khan, George T. Curlin. Dec 1977 (Rep. May 1980). 24 p.

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. Mar 1978. 16 p.

No. 9. Demographic Surveillance System-Matlab. Volume One. Methods and procedures. Mar 1978. 28 p.

No. 10. Demographic Surveillance System-Matlab. Volume Two. Census 1974 by Lado T. Ruzicka, A.K.M. Alauddin Chowdhury. Mar 1978. 48 p.

No. 11. Demographic Surveillance System-Matlab. Volume Three. Vital events and migration, 1975 by Lado T. Ruzicka, A.K.M. Alauddin Chowdhury. Mar 1978. 45 p.

No. 12. Demographic Surveillance System-Matlab. Volume Four. Vital events and migration, 1975 by Lado T. Ruzicka, A.K.M. Alauddin Chowdhury. Mar 1978. 48 p.

No. 13. Demographic Surveillance System-Matlab. Volume Five. Vital events, migration and marria[illegible], 1976 by Lado T. Ruzicka, A.K.M. Alauddin Chowdhury. Mar 1978. 55 p.

No. 14. Ten years review of the age and sex of cholera patients by Moslemuddin Khan, A.K.M. Jamiul Alam, A.S.M. Mizanur Rahman. May 1978. 18 p.

No. 15. A study of selected intestinal bacteria from adult pilgrims by M.I. Huq, G. Kibriya. Aug 1978 (Rep. Feb 1980). 15 p.

No. 16. Water sources and the incidence of cholera in rural Bangladesh by Moslemuddin Khan, W. Henry Mosley, J. Chakraborty, A. Majid Sarder, M.R. Khan. Dec 1978. 19 p.

No. 17. Principles and prospects in the treatment of cholera and related dehydrating diarrheas by William B. Greenough III. Jan 1979. 20 p.

No. 18. Demographic Surveillance System-Matlab. Volume Six. Vital events and migration 1977 by Aporn Samad, Kashem Sheikh, A.M. Sarder, Stanley Becker, Lincoln C. Chen. Feb 1979. 65 p.

No. 19. A follow-up survey of sterilization acceptors in the modified contraceptive distribution projects by Shushum Bhatia, Trinidad Osteria, J. Chakraborty, A.S.G. Faruque. Feb 1979. 25 p.

No. 20. Cholera due to the El Tor biotype equals the classical biotype in severity and attack rates by Moslemuddin Khan, Md. Shahidullah. Mar 1979. 20 p.

No. 21. An estimation of response bias of literacy in a census of rural Bangladesh by M. Shafiqul Islam, George T. Curlin, K.M.A. Aziz. Mar 1979. 26 p.

No. 22. *Vibrio cholerae* by William B. Greenough III. Apr 1979. 43 p.

No. 23. M.R. clients in a village based family planning programme by Shushum Bhatia, Lado T. Ruzicka. Apr 1979. 26 p.

No. 24. Passive hemagglutination assays for quantitation of cholera antitoxin gluteraldehyde and chromium chloride used as coupling reagents to sensitize human erythrocytes with purified choleragen by Ansaruddin Ahmed, Kh. Abdullah Al-Mahmud, George T. Curlin. Jun 1979. 25 p.

No. 25. Investigation of outbreak of dysentery due to *Shigella sonnei* in a small community in Dacca by M.I. Huq. Jun 1979. 21 p.

No. 26. Indigenous birth practices in rural Bandladeshi and their implications for a maternal and child health programme by Shushum Bhatia, J. Chakraborty, A.S.G. Faruque. Jul 1979. 24 p.

No. 27. Isolation, purification and characterization of a Shigella phage by M.I. Huq, M.A. Salek. Jul 1979. 18 p.

No. 28. Growth and development studies: Meheran by Moslemuddin Khan, George T. Curlin, J. Chakraborty. Jul 1979. 33 p.

No. 29. Report on reactigenicity and immunogenicity of Wellcome cholera toxoids in Bangladeshi volunteers by Robert E. Black, Md. Yunus, Abu Eusof, Ansaruddin Ahmed, M.R. Khan, David A. Sack. Jul 1979. 55 p.

No. 30. Strongyloides stercoralis larvae recovered from patients with diarrhoea and dysentery by G.H. Rabbani, Robert H. Gilman, Asma Islam. Jul 1979. 18 p.

No. 31. The condom in rural Bangladesh--a special effort is needed by Douglas Huber, Makhlisur Rahman, J. Chakraborty. Aug 1979. 14 p.

No. 32. The Matlab contraceptive distribution project by Makhlisur Rahman, W.H. Mosley, Atiqur Rahman Khan, A.I. Chowdhury, J. Chakraborty. Dec 1979. 119 p.

No. 33. Epidemiologic study of dysentery cases of Dacca urban area by Moslemuddin Khan, Md. Shahidullah. Jan 1980. 30 p.

No. 34. The gut as an immune organ by A.M. Molla. Feb 1980. 51 p.

No. 35. Microbiological surveillance of intra-neighbourhood El Tor cholera transmission in rural Bangladesh by W.M. Spira, Y.A. Saeed, M.U. Khan, M.A. Sattar. Mar 1980. 39 p.

No. 36. Lobon-gur (common salt and brown sugar) oral rehydration solution in the diarrhoea of adults by M.R. Islam, W.B. Greenough III, M.M. Rahaman, A.K. Azad Chowdhury, D.A. Sack. Apr 1980. 19 p.

No. 37. Utilisation of a diarrhoea clinic in rural Bangladesh: influence of distance, age and sex on attendance and diarrhoeal mortality by M. Mujibur Rahaman, K.M.S. Aziz, M.H. Munshi, Yakub Patwari, Mizanur Rahman. Jun 1980. 22 p.

No. 38. Birth care practice and neonatal tetanus in a rural area of Bangladesh by M. Shafiqul Islam, M. Mujibur Rahaman, K.M.S. Aziz, M.H. Munshi, Mizanur Rahman, Yakub Patwari. Jul 1980. 19 p.

No. 39. Hours of onset of cholera classical and El Tor and diarrhoea by Moslemuddin Khan. Aug 1980. 18 p.

No. 40. Socio-economic differentials in mortality in a rural area of Bangladesh by Stan D'Souza, Abbas Bhuiya, Mizanur Rahman. Nov 1980. 31 p.

No. 41. Reduction of neonatal mortality by immunization of non-pregnant women and women during pregnancy with aluminum adsorbed tetanus toxoid by Makhlisur Rahman, Lincoln C. Chen, J. Chakraborty, Md. Yunus, A.I. Chowdhury, A.M. Sarder, Shushum Bhatia, George T. Curlin. Jan 1981. 25 p.

No. 42. Are there barefoot doctors in Bangladesh: a study of non-government rural health practitioners by A.M. Sarder, Lincoln C. Chen. Jan 1981. 28 p.

No. 43. Factors related to acceptance of tetanus toxoid immunization among pregnant women in a maternal-child health programme in rural Bangladesh by Makhlisur Rahman, Lincoln C. Chen, J. Chakraborty, Md. Yunus, A.S.G. Faruque, A.I. Chowdhury. Jan 1981. 33 p.

No. 44. Infant mortality in rural Bangladesh: an analysis of cause during neonatal and postneonatal period by M. Shafiqul Islam, M. Mujibur Rahaman, K.M.S. Aziz, Mizanur Rahman, M.H. Munshi, Yakub Patwari. Apr 1981. 21 p.

No. 45. Role of water supply and sanitation in the incidence of cholera in refugee camps by Moslemuddin Khan. May 1981. 21 p.

No. 46. Infant deaths, determinants and dilemmas (A cohort analysis for rural Bangladesh) by A.K.M. Alauddin Chowdhury. May 1981. 30 p.

No. 47. Demographic surveillance system-Matlab. Volume Seven. Vital events and migration-1978 by Mridul K. Chowdhury, Stan Becker, Abdur Razzaque, A.M. Sarder, Kashem Shaikh, Lincoln C. Chen. May 1981. 80 p.

No. 48. Determinants of natural fertility study. Volume One. Methods and descriptive tables for the prospective study 1975-1978 by A.K.M. Alauddin Chowdhury, Stan Becker. May 1981. 55 p.

No. 49. Efficacy of short course antibiotic prophylaxis in controlling cholera in contacts during epidemic by Moslemuddin Khan. Jun 1981. 15 p.

No. 50. Patterns of shigella infection in families in rural Bangladesh by John M. Boyce, James M. Hughes, A.R.M.A. Alim, Moslemuddin Khan, K.M.A. Aziz, Joy G. Wells, George T. Curlin. Aug 1981. 21 p.

No. 51. Salmonella food poisoning in Bangladesh by Md. Yunus, Susan Zimicki, A.H. Baqui, K.M.B. Hossain, Martin J. Blaser. Aug 1981. 14 p.

No. 52. Epidemiology of El Tor cholera in rural Bangladesh: importance of surface water in transmission by James M. Hughes, John M. Boyce, Richard J. Levine, Moslemuddin Khan, K.M.A. Aziz, M.I. Huq, George T. Curlin. Sep 1981. 29 p.

No. 53. A clinical trial of ampicillin *versus* trimethoprim-sulfamethoxazole in the treatment of shigella dysentery by Md. Yunus, A.S.M. Mizanur Rahman, A.S.G. Faruque, R.I. Glass. Sep 1981. 20 p.

D. Special Publication:

No. 1. Management of cholera and other acute diarrhoeas in adults and children--World Health Organization. Sep 1977 (2nd Rep. Nov 1980). 26 p.

No. 2. Index to CRL publications and scientific presentations 1960-1976 by Susan Fuller Alamgir, M. Shamsul Islam Khan, H.A. Spira. Aug 1978. 70 p.

No. 3. Working manual for *E.coli* enterotoxin assay and ELISA assay for rota virus antigen by M.I. Huq, D.A. Sack, R.E. Black. Apr 1979. 32 p.

No. 4. Index to CRL publications and scientific presentations 1977-1978 and addenda for 1962. 1964-1976 by M. Shamsul Islam Khan. Jan 1980. 69 p.

No. 5. ICDDR,B Progress report 1979-1980. Apr 1980. 60 p.

No. 6. The treatment of acute diarrhoea in children a historical and physiological perspective by Norbert Hirschhorn. May 1980. 68 p.

No. 7. Campylobacter fetus SSP jejuni: a laboratory manual by Martin J. Blaser. Jun 1980. 40 p.

No. 8. Standing orders for evaluation and treatment of patients with diarrhoea symptoms who come to the Travellers Clinic at ICDDR,B. Sep 1980. 11 p.

No. 9. Proceedings of the National Workshop on Oral Rehydration. Oct 1980. 32 p.

No. 10. Proceedings of the Consultative Group meeting of the International Centre for Diarrhoeal Disease Research, Bangladesh. Nov 1980. 58 p.

No. 11. A review of findings on the impact of health intervention programme in two rural areas of Bangladesh by Makhlisur Rahman, Stan D'Souza. Nov 1980. 30 p.

No. 12. Training manual on treatment and prevention of diarrhoea. Dec 1980. 20 p. (English and Bengali)

No. 13. A population laboratory for studying disease processes and mortality the demographic surveillance system, Matlab, Comilla, Bangladesh by Stan D'Souza. Jan 1981. 45 p.

No. 14. Proceedings of the ICDDR,B Workshop: Medical Education on diarrhoeal disease and related subjects. Sep 1981. 40 p.

E. Monograph Series:

No. 1. Kinship in Bangladesh by K.M. Ashraful Aziz. May 1979. 250 p. (Price Tk. 85.00/£5.00/US $10.00).

F. Thesis and Dissertation:

No. 1. Chlorpromazine as a therapeutic antisecretory agent in cholera and related diarrhoeas by G.H. Rabbani. Dec 1980. 73 p.

No. 2. Village practitioners of Bangladesh: their characteristics and role in an oral rehydration programme by A.S.M. Mizanur Rahman. Feb 1981. 72 p.

No. 3. Complications of measles in rural Bangladesh (Long term complications in the under-two) by Niger S. Shahid. Jun 1981. 49 p.

G. GLIMPSE: ICDDR,B Monthly Newsletter. Vol. 1, No. 1, Jan 1979 --