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MAY 1970—APRIL 1971

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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

The mid year population of Matlab Demographic Surveillance System for 1970-71 was estimated with an adjustment of births, deaths and migrations. An average annual rate of increase of 2.4% was found. The CBR and CDR were lower than the preceding years and the crude rate of natural increase was 2.9%. Out-migration rate was 22.1 and in-migration rate 30.8. Both male and female in-migration was more than out-migration.

In the neonatal period, death rate among male infants was higher than the female infants. Whereas in the post-neonatal period death rate among the female infants was higher than the male infants. Overall, infant mortality rate was higher among the male than the female. The age specific death rates showed a U shape pattern. The peak occurred during October to December 1970-1971 and earlier years. This peak period of death coincides with the peak in winter which causes death among the children <1 and above 40 years during 1970-1971 and earlier years. Over two-thirds of children <1 year reportedly died of 'Tākurīā' i.e. cause 'unknown' and about a half of the above 40 years old persons died of 'dropsy, asthma, rheumatism etc.' i.e. 'others'. The life expectancy of males was higher than females.

Sex ratio at birth was 101 males per 100 females. October-December period of 1970-71 was the peak period for pregnancy termination. Higher number of first pregnancies were terminated in September-November. Second and third pregnancies were terminated mostly during October-January. Four through seven pregnancies were terminated during October-December and beyond, seven were terminated largely during October-November. Overall, most of the conceptions took place during the spring and early summer (February-April) seasons. The peak age specific fertility rate was 329.7 for women aged 20-24. The intrinsic rate of natural increase was 2.88% per year.

INTRODUCTION

The Cholera Research Laboratory (now ICDDR,B), as a part of Cholera Vaccine Field Trial, has been maintaining a continuous registration of births, deaths and migrations, in a population of over 110,000 in 132 villages at Matlab Thānā in Comilla district of Bangladesh since May 1966. In 1968, the vaccine field trial area was expanded by including 101 new villages with a population of over 110,000. This population added in 1968 has not been included in the present analysis. The analysis of annual data from May 1966 to April 1969 was published earlier (Mosley *et al.* 1968; Chowdhury *et al.* 1969 and 1970). This paper gives a descriptive analysis of the demographic data for the fifth year and shows some trends over a period of five years.

A description of the area, methods and definitions were discussed in the first annual report (Mosley *et al.* 1968:1-3).

RESULTS

In the 1966 census there were 111,748 people in 132 villages of the study area. Table 1 shows that the population reached 124,642 by the middle of the fifth year giving an average growth rate of 2.46% per year. The mid-year population was obtained by adding the live-births and in-migrants and subtracting deaths and out-migrants with an adjustment of age (Appendix A) for the four and one half year period of the study. The sex ratio was 103.1 males for 100 females. Children below 14 years represented 48% of the total population.

Table 2 summarizes the total number of live-births, deaths and migrations for five consecutive twelve-month study periods. The crude birth rate fell from 47.1 to 45.4 per 1000 in the second year, it became 46.6 in the third year and thereafter it followed a downward trend in the fourth and fifth year. The crude death rate increased from 15.0 to 16.6 per 1000 in the second year and decreased in the third year; it was stable in the fourth year and fell slightly in the fifth year. There was a significant net out-migration in the first two years that was considerably reduced in the subsequent two years. The net migration flow reversed its direction in 1970-1971.

MORTALITY

Table 3 shows the distribution of total infant deaths by age at death. Overall, 54.5 per thousand live-births died within the first week of their birth; 89.9 per thousand died within the first month and 131.3 per thousand died before reaching the age of one year. Most of the infant deaths were reported to be associated with *Tākarīā* or evil spirits. The table shows higher female than-male mortality in the post-neonatal period.

TABLE 1

ADJUSTED MID-YEAR POPULATION BY AGE AND SEX 1970 - 1971

Age	Male	Female	Total	Sex Ratio	Cumulative Percent		
					Male	Female	Total
<1	2410	2406	4816	100.2	3.8	3.9	3.9
1 - 4	7909	7422	15331	106.6	16.3	16.0	16.2
5 - 9	10516	10259	20775	102.5	32.9	32.7	32.8
10 - 14	9982	8781	18763	113.7	48.7	47.0	47.9
15 - 19	6693	6114	12807	109.5	59.3	57.0	58.2
20 - 24	3326	3931	7257	84.6	64.5	63.4	64.0
25 - 29	2947	4905	7852	60.1	69.2	71.4	70.3
30 - 34	3320	4321	7641	76.8	74.4	78.4	76.4
35 - 39	3677	3497	7174	105.1	80.2	84.1	82.2
40 - 44	3026	2560	5586	118.2	85.0	88.3	86.7
45 - 49	2341	1747	4088	134.0	88.7	91.2	89.9
50 - 54	2142	1758	3900	121.8	92.1	94.0	93.1
55 - 59	1665	1319	2984	126.2	94.7	96.2	95.5
60 - 64	1145	949	2094	120.7	96.6	97.7	97.1
65 & above	2179	1395	3574	156.2	100.0	100.0	100.0
Total	63278	61364	124642	103.1			

APPENDIX A

The method of estimation of 1970-71 mid-year population by age and sex.

The estimation of the total population for each sex was based on the balancing equation: (Shryock and Siegel, 1973: 736-738).

$$P(1970-71) = P(1969-70) + B - D + I - O$$

Where P is mid-year population of all ages

B is all Births

D is all Deaths

I is all in-migrants

O is all out-migrants

Population sizes for different ages:

$$\text{Age under 1 year: } P_0(1970-71) = B - 0.8D_0 - 0.5M_0$$

$$\text{Age one year : } P_1(1970-71) = P_0(1969-70) - \{0.2D_0 + 0.5D_1 - 0.5M_0 - 0.5M_1\}$$

Ages 2 year and above:

$$P_t(1970-71) = P_{t-1}(1969-70) - \{P_a^t - \frac{1}{2}(D_a - M_a) + \frac{1}{2}(D_{a+1} - M_{a+1})\}$$

D_0 is all deaths of age under one year.

M_0 is all net-migrants of age under one year.

D_1 is all deaths of aged one year.

M_1 is all net-migrants of aged one year.

TABLE 2

SUMMARY OF BIRTHS, DEATHS AND MIGRATION RATES FOR FIVE CONSECUTIVE YEARS DURING MAY 1966 - APRIL 1971

	1966-67	1967-68	1968-69	1969-70	1970-71	Average for five years
*Live Birth	47.1	45.4	46.6	45.4	43.3	45.6
*Death	15.0	16.6	15.0	15.0	14.8	15.3
Natural Increase %	3.2	2.9	3.2	3.0	2.9	3.0
*Migration-in	16.7	35.0	28.0	25.8	30.8	27.3
*Migration-out	31.4	47.3	29.6	30.5	22.1	32.2
**Net balance of migration	14.7	12.3	1.6	4.7	-8.7	4.9

* Per 1,000 mid-year population

** (Out-migration) - (in-migration)

TABLE 3

INFANT AND NEONATAL DEATH FOR 1970 - 1971

Age	Male	Female	Both	Rate/1000		
				Male	Female	Both
Neonatal						
0-7 days	164	130	294	60.7	48.3	54.5
8-29 days	100	91	191	37.0	33.8	35.4
Post-neonatal						
1-11 months	100	123	223	37.0	45.7	41.3
All Infants	364	344	708	134.6	127.9	131.3

Table 4 and Figure 1 show the age and sex specific mortality rates. Overall, the female mortality rate was higher than that of the males. The male infant mortality rate was higher than the female one. Among the children aged 1-4 years, mortality of females was higher than that of males. One of the reasons of this high mortality of female children may be that the parents take comparatively better care of male than female children. It may be noted here that various demographic studies (Khan and Sirageldin 1977:481; Aziz and Hossain 1974:27) in Bangladesh show a strong preference for male children. The higher female than male mortality continued at ages 15-39. This excessive mortality among females compared with the males coincides with the reproductive phase of the life-cycle. A study by Chen *et al.* (1974:29) drawing on data from this area showed an average of 5.5 deaths per thousand live-births within the said age group. In this study the women of 45-49 age group have a demonstrated fertility capacity, but the risks of maternal mortality in this age group could not be identified (Chen *et al.* 1974:29) and the mortality rate among the females was lower compared with the males. Again female mortality was much higher than male mortality above 60 years of age. This may be attributed to the neglect of women in the old ages when most of them become widowed and face sudden loss of economic support.

TABLE 4

AGE SPECIFIC DEATH RATES BY SEX DURING MAY 1970 - APRIL 1971

Age	Male	Female	Total	Rate per 1000		
				Male	Female	Both
<1	364	344	708	134.6	127.9	131.3
1 - 4	175	274	449	22.1	36.9	29.3
5 - 9	14	32	46	1.3	3.1	2.2
10 - 14	14	9	23	1.4	1.0	1.2
15 - 19	5	11	16	0.8	1.8	1.3
20 - 24	4	11	15	1.2	2.8	2.1
25 - 29	7	16	23	2.4	3.3	2.9
30 - 34	7	12	19	2.1	2.8	2.5
35 - 39	7	15	22	1.9	4.3	3.1
40 - 44	19	16	35	6.3	6.2	6.3
45 - 49	31	18	49	13.2	10.3	12.0
50 - 54	27	22	49	12.6	12.5	12.6
55 - 59	29	20	49	17.4	15.2	16.4
60 - 64	30	35	65	26.2	36.9	31.0
65 - 69	34	41	75	34.2	58.2	44.1
70 & above	108	88	196	91.1	127.5	104.5
Total	875	964	1839	13.8	15.7	14.8

FIG.1 AGE SPECIFIC DEATH RATE BY SEX 1970-71

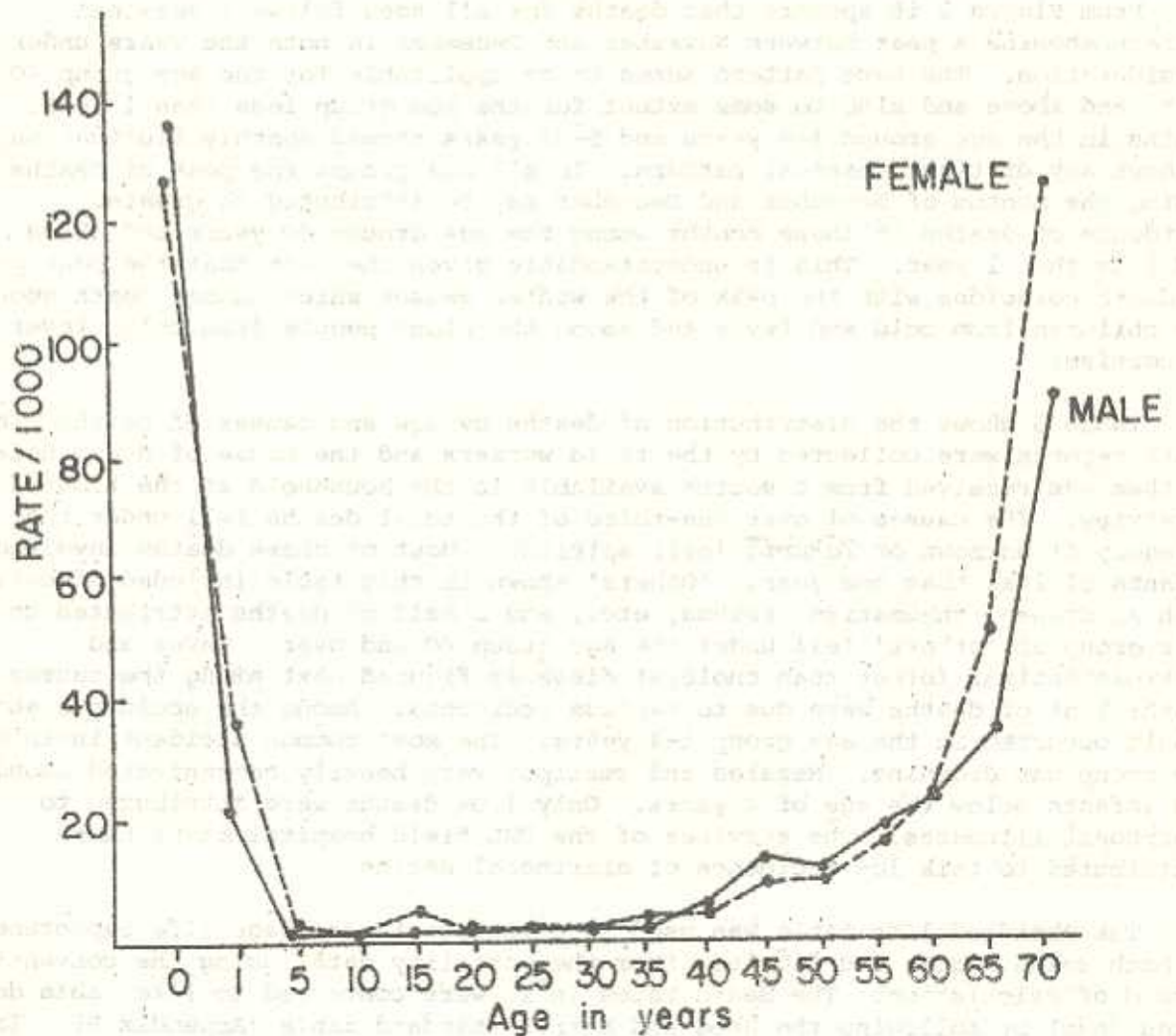


Table 5 shows the seasonal pattern of deaths. The lower death rates were registered during May to July and during March to April. The peak was found from mid October to early January. The higher percentage of deaths during this period might be to a certain extent related to higher pregnancy terminations during this period.

From Figure 2 it appears that deaths for all ages follow a seasonal pattern showing a peak between November and December in both the years under consideration. The same pattern seems to be applicable for the age group 40 years and above and also to some extent for the age group less than 1 year. Deaths in the age groups 1-4 years and 5-39 years showed monthly fluctuation without any distinct seasonal pattern. In all age groups the peak of deaths during the months of November and December may be attributed to greater incidence of deaths in these months among the age groups 40 years and above and less than 1 year. This is understandable given the fact that the peak period of death coincides with the peak of the winter season which causes death among the children from cold and fever and among the older people from cold, fever and rheumatism.

Table 6 shows the distribution of deaths by age and causes of death. The death reports were collected by the field workers and the cause of death noted by them was received from a source available in the household at the time of interview. The causes of over one-third of the total deaths fell under the category of unknown or *Tākuriā* (evil spirits). Most of these deaths involved infants of less than one year. 'Others' shown in this table included diseases such as dropsy, rheumatism, asthma, etc., and a half of deaths attributed to this group of 'others' fell under the age group 40 and over. Fever and gastrointestinal (other than cholera) diseases figured next among the causes of death; 5.5% of deaths were due to various accidents. Among the accidents about a half occurred in the age group 1-4 years. The most common accident in this age group was drowning. Measles and smallpox were heavily concentrated among the infants below the age of 4 years. Only 1.0% deaths were attributed to diarrhoeal illnesses. The services of the CRL field hospital might have contributed to this low incidence of diarrhoeal deaths.

The abridged life table was used to calculate the average life expectancy of both sexes, males and females, from the mortality data, using the conventional method of calculation. The death rates (n^M_x) were converted to life table death rates (n^d_x) by following the Reed and Merrel standard table (Appendix B). Table 7 shows the life expectation at birth to be 49.9 years for both sexes; it was higher for males than the females.

FERTILITY

Table 8 shows the outcome of pregnancy according to the age of mother. Among the live-births 50.1% were males yielding a sex ratio of 101.0 males per 100 females. Thirty-eight multiple births were terminated during the year 1970-1971 with a ratio of 153 pregnancies for every multiple birth. The children who were

TABLE 5

AGE DISTRIBUTION OF PERSONS WHO DIED DURING MAY 1970 - APRIL 1971
BY 4-WEEK PERIODS

Months	Week No.	A g e								Total	
		<1	%	1-4	%	5-39	%	40 & above	%		
May 1 - May 28	1-4	38	5.4	25	5.6	9	5.5	26	5.0	98	5.3
May 29 - June 25	5-8	48	6.8	34	7.6	11	6.7	22	4.2	115	6.3
June 26-July 23	9-12	50	7.1	40	8.9	8	4.9	33	6.4	131	7.1
Jul. 24 - Aug. 20	13-16	68	9.6	25	5.6	14	8.5	40	7.7	147	8.0
Aug. 21 - Sep. 17	17-20	60	8.5	39	8.7	3	1.8	34	6.6	136	7.4
Sep. 18 - Oct. 15	21-24	59	8.3	46	10.2	11	6.7	32	6.2	148	8.0
Oct. 16 - Nov. 12	25-28	59	8.3	36	8.0	11	6.7	52	10.0	158	8.6
Nov. 13 - Dec. 10	29-32	78	11.0	38	8.5	14	8.5	56	10.8	186	10.1
Dec. 11 - Jan. 7	33-36	54	7.6	39	8.7	21	12.8	50	9.7	164	8.9
Jan. 8 - Feb. 4	37-40	58	8.2	36	8.0	10	6.1	51	9.8	155	8.4
Feb. 5 - Mar. 4	41-44	57	8.0	30	6.7	18	11.0	48	9.3	153	8.3
Mar. 5 - Apr. 1	45-48	38	5.4	26	5.8	18	11.0	34	6.6	116	6.3
Apr. 2 - Apr. 30	49-52	41	5.8	35	7.7	16	9.8	40	7.7	132	7.3
Total		708		449		164		518		1839	100.0
Percent		38.5		24.4		8.9		28.2		-	-

FIG.2. SEASONAL PATTERN OF DEATHS BY DIFFERENT AGE GROUPS AND ALL AGES (MAY, 1969-APRIL, 1971)

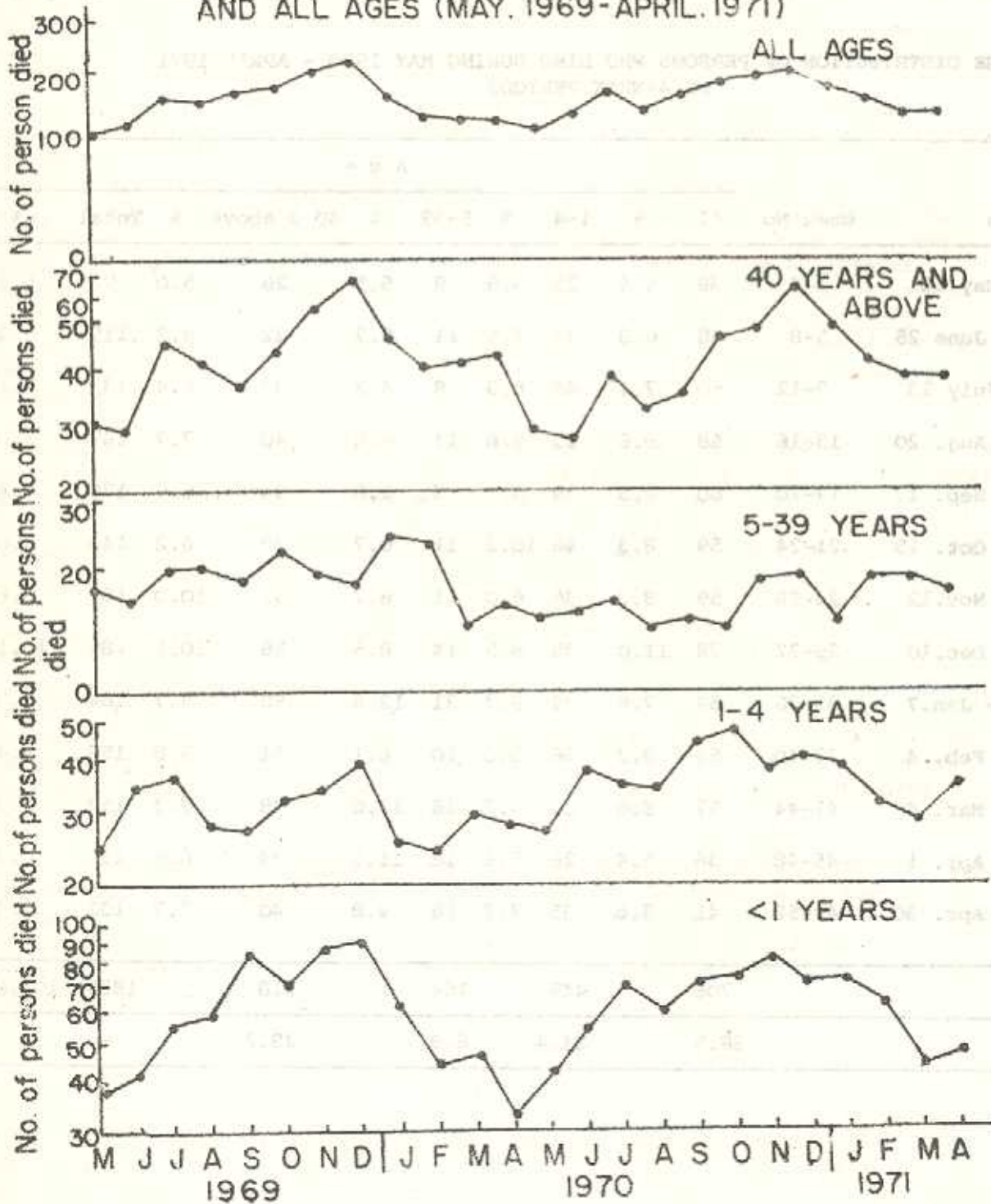


TABLE 6

DISTRIBUTION OF PERSONS WHO DIED FROM MAY 1970 - APRIL 1971
ACCORDING TO THEIR AGE AT DEATH AND CAUSE OF DEATH

Causes of Death	A g e s					Total	Percent
	<1	1-4	5-14	15-39	40+		
Fever (all forms)	76	103	21	15	50	265	14.4
Acute Diarrhoea	4	13	-	-	2	19	1.0
Gastrointestinal Diseases (Other than cholera)	15	102	8	9	102	236	12.8
Respiratory Diseases	57	51	10	13	72	203	11.0
Measles & Smallpox	12	49	3	-	1	65	3.5
Accident	6	49	10	15	21	101	5.5
Unknown	528	29	5	-	15	577	31.4
Others	10	53	12	43	255	373	20.3
Total	708	449	69	95	518	1839	
Percent	38.5	24.4	3.8	5.1	28.2		

APPENDIX B

Notation for abridged life table: (Barclay 1958, page 286-297).

$$n^q_x = \frac{2n \cdot n^M_x}{2 + n \cdot n^M_x}$$

$$n^p_x = 1 - n^q_x$$

$$n^d_x = l_x \cdot n^q_x$$

$$l_{x+n} = l_x - n^d_x$$

$$n^L_x = \frac{n(l_x + l_{x+n})}{2}$$

$$L_0 = 0.3l_0 + 0.7l_1$$

Assumed

$$L_{70+} = (l_{70+} \cdot \log l_{70+})$$

$$T_x = \sum_{70+}^x n^L_x$$

$$e_{ox} = \frac{T_x}{l_x}$$

TABLE 7

AVERAGE LIFE EXPECTANCY e_{0x} AT SPECIFIED AGES BY SEX
(BASED ON 1970 - 71 DEATH REPORTS)

Ages	Males	Females	Both
0	51.95	47.96	49.94
1	58.98	53.94	56.44
5	60.26	58.23	59.22
10	55.64	54.10	54.85
15	51.02	49.37	50.17
20	46.20	44.79	45.47
25	41.46	40.39	40.91
30	36.93	36.01	36.48
35	32.29	31.48	31.91
40	27.58	27.11	27.36
45	23.38	22.89	23.15
50	19.81	18.97	19.43
55	15.93	15.03	15.53
60	12.16	11.02	11.64
65	8.51	7.75	8.18
70	4.64	4.53	4.59

born dead after a gestation period of 7th month or more were 32.3 per thousand pregnancies. This gave a ratio of 1 stillbirth for every 30.1 live-birth. The actual number of miscarriages remained unknown since the early pregnancies mostly could not be identified. 298 miscarriages were recorded during the one year period yielding a ratio of 19.6 pregnancies for every miscarriage.

Table 9 and Figure 3 show the monthly distribution of pregnancy terminations. This table indicates that the peak period of pregnancy terminations fell within the months of October through December. High percentage of first pregnancy terminations occurred during September to November. Subsequently high percentages of second and third pregnancy terminations occurred during the months of October through January. In the case of terminations of 4-7 pregnancies there followed a constant seasonality pattern with a peak in October through December. Finally, the pregnancy terminations of 8th and higher order showed a higher than average occurrence during October and November. Most of the terminations of the young mothers occurred during September to November but the older mothers mostly had the termination in October through November. Overall, most of the conceptions occurred during the spring and early summer (February to April). During this period the pressure of work is less in the rural areas and this may partially account for the higher conception rate in this period.

Table 10 shows the age specific fertility pattern; the general fertility rate was 150.4 births per thousand women aged 10-49 years. The ASFRs increased with the age of the mother giving the highest rate of live-birth terminations in the age group 20-24 years.

Table 11 shows that the gross reproduction rate was 2.98. From the mortality experience of the population in 1970-71, the net reproduction rate was 2.14. The mean length of generation was 26.8 years and the intrinsic rate of natural increase was 2.88% per year.

MIGRATION

Table 12 shows the rates of in-migration and out-migration separately by age and sex. In the age group 0-4, the in-migration rate was slightly higher for males than for females, but in the case of out-migration, the rates were equal. In the age group 5-19, migration rate of females was higher than that of males with a peak in the 15-19 age group. The higher rate of female movements could be attributed to the marital events which took place frequently within this age group. The main factor behind female movements was the change of residence (movement to the husband's house) following marriage. At ages 20 years and above, both in-migration and out-migration were found to be higher among males than females. The male movements occurred mainly to find jobs and to take up employments. Overall, the frequency of out-migration was significantly lower than that of in-migration which reflected the mass flow of people to the

TABLE 9

DISTRIBUTION OF WOMEN WHO EXPERIENCED PREGNANCY DURING MAY 1970-APRIL 1971
ACCORDING TO THE MONTH OF TERMINATION

Month of Termination	No. of Pregnancies				All Preg- nancies	Percentage				All Preg- nancies
	1	2-3	4-7	8+		1	2-3	4-7	8+	
1970 May	48	90	132	62	332	5.0	5.9	5.8	5.9	5.7
June	38	79	146	66	329	3.9	5.2	6.4	6.3	5.6
July	85	96	145	68	394	8.8	6.3	6.3	6.5	6.8
Aug.	86	105	113	53	357	8.9	6.9	4.9	5.1	6.1
Sept.	109	139	204	73	525	11.3	9.1	8.9	7.0	9.0
Oct.	125	179	260	114	678	12.9	11.7	11.4	10.9	11.6
Nov.	106	216	333	142	797	11.0	14.1	14.5	13.5	13.7
Dec.	94	156	232	103	585	9.7	10.2	10.1	9.8	10.0
1971 Jan.	91	172	215	98	576	9.4	11.2	9.4	9.3	9.9
Feb.	67	112	187	98	464	6.9	7.3	8.2	9.3	7.9
Mar.	63	102	202	104	471	6.5	6.7	8.8	9.9	8.1
Apr.	55	81	121	68	325	5.7	5.3	5.3	6.5	5.6
Total	967	1527	2290	1049	5833	100.0	100.0	100.0	100.0	100.0

FIG. 3. SEASONAL PATTERN OF PREGNANCY TERMINATION BY DIFFERENT NUMBER OF PREGNANCY AND ALL PREGNANCIES (MAY '70-APRIL '71)

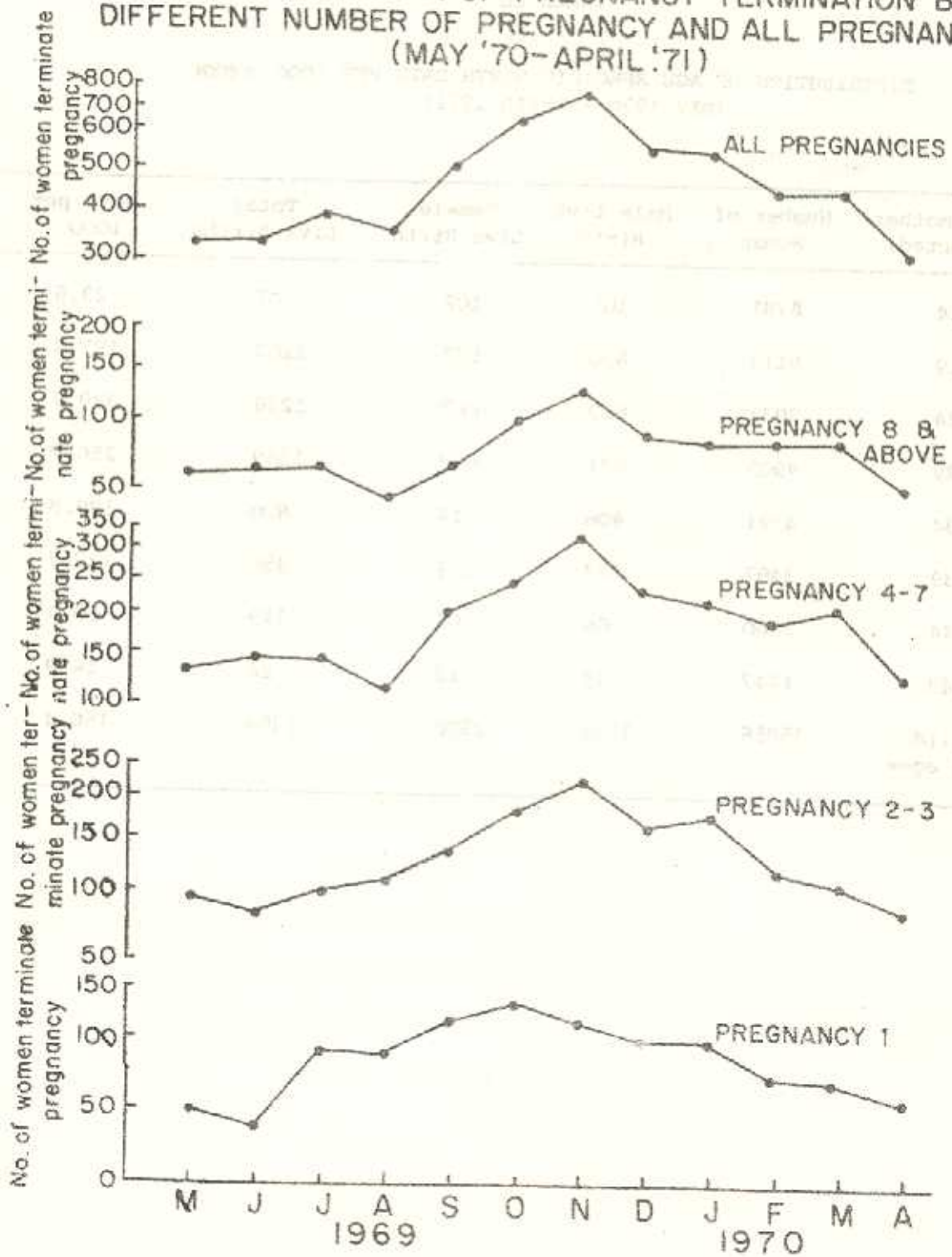


TABLE 10

DISTRIBUTION OF AGE SPECIFIC BIRTH RATE PER 1000 WOMEN
(MAY 1970 - APRIL 1971)

Age of Mother (corrected)	Number of Women	Male Live Birth	Female Live Birth	Total Live Births	Rate per 1000
10-14	8781	105	102	207	23.6
15-19	6114	630	577	1207	197.4
20-24	3931	629	667	1296	329.7
25-29	4905	631	628	1259	256.7
30-34	4321	406	414	820	189.8
35-39	3497	223	227	450	128.7
40-44	2560	66	63	129	50.4
45-49	1747	14	12	26	14.9
All child- bearing ages	35856	2704	2690	5394	150.4

TABLE 11

CALCULATION OF GROSS AND NET REPRODUCTION RATES
AND INTRINSIC RATE OF NATURAL INCREASE

Age	Female Popula- tion	Live Birth Female	Daugh- ters per 1000	Pivot- al Age	Proportion Surviving the Pivotal Age	Women Surviving at given Age	Person Years
10-14	8781	102	11.6	12.5	.74055	8.6	107.5
15-19	6114	577	94.4	17.5	.73677	69.6	1218.0
20-24	3931	667	169.7	22.5	.73016	123.9	2787.8
25-29	4905	628	128.0	27.5	.72002	92.2	2535.5
30-34	4321	414	95.8	32.5	.70837	67.9	2206.7
35-39	3497	227	64.9	37.5	.69860	45.3	1698.7
40-44	2560	63	24.6	42.5	.68378	16.8	714.0
45-49	1747	12	6.9	47.5	.66274	4.6	218.5
Total			595.9			428.9	11486.7
5X Total			2979.5			2144.5	57433.5

Gross Reproduction Rate 2.98

Net Reproduction Rate 2.14

Mean Length of Generation 26.78

Intrinsic Rate of Natural
Increase 2.88% per year

TABLE 12

AGE AND SEX SPECIFIC MIGRATION RATE FOR THE YEAR 1970 - 1971

Age	Male		Female		Both Sexes	
	In	Out	In	Out	In	Out
	Rate per 1000 Population					
0 - 4	2.5	2.1	2.3	2.1	2.4	2.1
5 - 9	1.9	1.6	2.3	1.8	2.1	1.7
10 - 14	1.9	1.5	2.7	4.5	2.3	2.9
15 - 19	3.3	2.8	8.6	5.1	5.8	3.9
20 - 24	7.5	3.7	4.9	3.2	6.1	3.4
25 - 29	9.7	3.5	2.5	1.7	5.2	2.4
30 - 34	6.7	1.9	1.6	1.2	3.8	1.5
35 - 39	4.0	2.0	1.6	1.0	2.8	1.5
40 - 44	2.5	1.5	0.7	1.0	1.7	1.3
45 - 49	3.8	1.0	1.4	1.0	2.8	1.0
50 - 54	2.6	1.3	1.3	1.0	2.0	1.1
55 - 59	2.1	1.0	0.7	0.9	1.5	0.9
60 - 64	0.7	1.6	1.8	1.7	1.2	1.6
65 - 69	1.3	0.8	0.8	0.8	1.1	0.8
70 & above	0.9	1.3	2.0	2.2	1.3	1.7
Total	3.3	2.0	2.9	2.5	3.0	2.1

villages during the period of the liberation movement and the war of independence. Most of the study villages were surrounded by rivers and canals without any road connection. Such a geographic location provided a comparatively safe shelter for the residents during the agonizing period of war of independence.

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