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DEMOGRAPHIC STUDIES IN RURAL BANGLADESH

MAY 1973—APRIL 1974

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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 annual report, working paper, scientific report, special publication, monograph, thesis and dissertation, and newsletter 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

Children under 14 and adults over 60 comprise 46.5 and 4.8 percent, respectively of the total population. The CBR rose from 42.1 per 1000 the previous year to 47.9 per 1000 during the 1973-74 period. The death rate declined from 16.3 to 14.2 per 1000 during this period. The CBR and CDR resulted in a crude rate of natural increase of 3.4 percent during this period. The in-and out-migration rates were 17.2 and 21.2 per 1000 population respectively. The net balance of migration was 4 per 1000 population.

One hundred and twenty-six infants per 1000 die in the first year of life. Male mortality exceeded female mortality from age 40 onward except 65 and above ages. Overall, there was very little seasonal variation in death rates, with the exception of the youngest age group. Over one-third of the total deaths were classified as unknown or *takuria* (evil spirits). Most of these deaths occurred amongst infants aged one year or less. Gastrointestinal diseases and fever were amongst the leading causes of death. For both sexes the life expectation at birth was 50.8 year.

The sex ratio at birth was 103 males per 100 females, one stillbirth occurred for every 27.2 live births. One miscarriage occurred for every 18.8 pregnancies. The gross reproduction rate was 3.5, the net reproduction rate was 2.6 and the mean length of generation was 28.5 years.

INTRODUCTION

Since 1963, the International Centre for Diarrhoeal Disease Research, Bangladesh (former the Cholera Research Laboratory) has been maintaining a continuous registration of births, deaths and migrations in Matlab thana, Comilla District as part of a cholera vaccine trial surveillance. In 1966, this demographic surveillance system was enlarged and a census was conducted covering 132 villages with a population of 111,748, called the "old trial area (OTA)". In 1968, the vaccine trial surveillance area was further expanded to include an additional 101 villages with a population of 109,055 people, called the "new trial area (NTA)". Both OTA and NTA villages are included in the following analysis. Annual data for the period covering May 1966 to April 1971 were presented in earlier publications (Mosley *et al.* 1968; Chowdhury *et al.* 1969, 1970; Chowdhury *et al.* 1981a and 1981b). In this paper, a descriptive analysis of the demographic data is provided for the period May 1971 to April 1972. A general description of the study areas and the surveillance system have been provided in the initial annual report (Mosley *et al.* 1968).

RESULTS

There were 111,748 persons in the 132 villages at the time of the census in April 1966 and 109,055 persons in the 101 villages at the time of the census in April-May 1968. As illustrated in Table 1, the population reached 246,423 in 233 villages by the middle of 1971-72. This adjusted mid-year population for 1971-72 has been obtained by adding the live-births and in-migrants to the 1970-71 base population and by subtracting the deaths and out-migrants, with an adjustment made for age (see Appendix A).

Table 2 provides a summary of the total live births, deaths and migrations for the period May 1971 to April 1972. The crude birth rate (CBR) was 44.6 per 1000 representing a slight increase from that of the preceeding year (43.3 per 1000). In conjunction with a crude death rate (CDR) of 20.6 per 1000 (the highest since 1966), the result was a crude rate of natural increase of 2.4 percent. The reason for this higher figure may be attributed primarily to the war of liberation and secondarily to the attendant problems of non-availability of food and inadequate transportation. The in-and out-migration rates were 29.5 and 30.6 per 1000, respectively, resulting in an overall net out-migration rate of 1.1 per 1000 population.

MORTALITY

The classification of 1614 neonatal and post-neonatal deaths recorded

TABLE 1

ADJUSTED MID-YEAR POPULATION BY AGE AND SEX, MAY 1973 - APRIL 1974

Age	Male	Female	Total	Sex ratio	Cumulative percent		
					Male	Female	Total
< 1	5619	5448	11067	103.1	4.3	4.3	4.3
1-4	17405	16564	33969	105.1	17.5	17.4	17.4
5-9	18423	17192	35615	107.1	31.5	31.0	31.2
10-14	20381	19132	39513	106.5	46.9	46.1	46.5
15-19	16209	12987	29196	124.8	59.3	56.4	57.9
20-24	9047	9403	18450	96.2	66.1	63.8	65.0
25-29	5493	8047	13540	68.3	70.3	70.2	70.2
30-34	6436	9046	15482	71.2	75.2	77.4	76.2
35-39	6312	6811	13123	92.7	80.0	82.7	81.3
40-44	6661	5746	12407	115.9	85.0	87.3	86.1
45-49	4869	4204	9073	115.8	88.7	90.6	89.6
50-54	4365	3522	7887	123.9	90.0	93.4	92.7
55-59	3407	3145	6552	108.3	94.6	95.9	95.2
60-64	2304	1797	4101	128.2	96.4	97.3	96.8
65 and above	4781	3423	8204	139.7	100.0	100.0	100.0
Total	131712	126467	258179	104.2			

APPENDIX A

The method of estimation of 1973-74 mid-year population by age and sex.

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

$$P_1 (1973-74) = P_0 (1972-73) + B - D + I - O$$

Where P_1 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:

$$\text{Age under 1 year: } P_0 (1973-74) = B - 0.8D_0 - 0.5M_0$$

$$\text{Age one year: } P_1 (1973-74) = P_0 (1972-73) - \{0.2D_0 + 0.5D_1 - 0.5M_0 - 0.5M_1\}$$

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.

$$\begin{aligned} \text{Age 2 years and above: } P_t (1973-74) - P_{t-1} (1972-73) - \{P_a^t - \frac{1}{2}(D_a - M_a) \\ + \frac{1}{2}(D_{a+1} - M_{a+1})\} \end{aligned}$$

P^t is the original population at the beginning of the year.

a refers to age.

TABLE 2

SUMMARY OF BIRTHS, DEATHS AND MIGRATIONS MAY 1973 - APRIL 1974

	Number	Rate per 1000 population	
		Male	Female
Live births	12370	47.9	47.9
Deaths	3665	14.2	14.2
Migration in	4431	17.2	17.2
Migration out	5476	21.2	21.2
*Net balance of migration	1045	4.0	4.0

* (out-migration) - (in-migration)

TABLE 3

INFANT AND NEONATAL DEATH MAY 1973 - APRIL 1974

Age	Male	Female	Both	Rate per 1000 population		
				Male	Female	Both
All infants	790	769	1559	125.8	126.3	126.0
<u>Neonatal</u>						
0-7 days	343	278	621	54.6	45.6	50.2
8-29 days	196	180	376	31.2	29.6	30.4
<u>Post-Neonatal</u>						
1-11 months	251	311	562	40.0	51.1	45.4

than females in the neonatal period. In the post-neonatal period, female mortality exceeded male mortality, in all likelihood of a reflection of the very strong son preference in this region, and the related tendency to provide more food and medical care for male offspring (Aziz 1979:52; D'Souza *et al.* 1980:26; Chen *et al.* 1981:60-61).

Table 4 and Figure I show the distribution of deaths by age and sex during the period. The excess mortality among female children is most pronounced in the 1-4 year age group, although this differential is maintained throughout the childbearing years. Except among the oldest age group, male mortality exceeded female mortality from age 40 onward.

Table 5 and Figure II shows the seasonal pattern of deaths during the 1973-1974 period. With some variation, death rates were generally highest during the October-November period. Among infants the higher percentage of deaths during this period may to a certain extent be related to the higher frequency of births during this period with the attendant neonatal and post-neonatal deaths. Overall, there is very little seasonal variation in death rates, with the exception of the youngest age group.

Table 6 shows the distribution of deaths by age and by cause of death. The death reports were collected by the field workers and the causes of death noted by them was recorded from a reliable source available in the household at the time of interview. Over one-third of the total deaths were classified as unknown or *tākuriā* (evil spirits). Most of these deaths involved infants aged one year or less. The category of 'other' included diseases such as dropsy, rheumatism, asthma, etc., and more than a half of deaths attributed to this cause occurred in the oldest age group. Gastrointestinal diseases and fever comprised the next largest cause of death. Only 1.2 percent of all deaths were attributed to diarrhoeal diseases. The existence of services of the ICDDR,B field hospital may be largely responsible for this very low incidence of diarrhoeal deaths. Table 6 shows that the maternal mortality rate was eight per thousand, little different from the maternal mortality rate of six per thousand during the 1968-70 period (Chen *et al.* 1974:20).

The abridged life table was used to calculate the average life expectancy of males and females separately and jointly, using conventional methods of calculation. The death rates were converted to life table death rates by following Reed and Merrell Standard table (see Appendix B). Table 7 shows the life expectation at birth to be 50.8 years for the total population, and to be higher for male than for female (51.9 vs. 49.8 years). From age 10 onward, life expectancies for females are comparable to those for males, reflecting the much higher rate of female mortality during early childhood.

FERTILITY

Table 8 shows the outcome of pregnancy according to the age of mother.

TABLE 4

AGE SPECIFIC DEATH RATES BY SEX MAY 1973 - APRIL 1974

Age	Male	Female	Both	Rate per 1000 population		
				Male	Female	Both
< 1	790	769	1559	125.8	126.3	126.0
1-4	242	395	637	13.9	23.8	18.8
5-9	57	58	115	3.1	3.4	3.2
10-14	22	19	41	1.1	1.0	1.0
15-19	14	38	52	0.9	2.9	1.8
20-24	10	22	32	1.1	2.3	1.7
25-29	14	38	52	2.5	4.7	3.8
30-34	16	30	46	2.5	3.3	3.0
35-39	25	29	54	4.0	4.3	4.1
40-44	44	32	76	6.6	5.6	6.1
45-49	51	23	74	10.5	5.5	8.2
50-54	53	26	79	12.1	7.4	10.0
55-59	57	42	99	16.7	13.4	15.1
60-64	78	59	137	33.9	32.2	33.4
65 and above	340	272	612	71.1	79.5	74.6
Total	1813	1852	3665	13.8	14.6	14.2

* Rate per 1000 live births. Others rates based on per 1000 population.

Fig. 1
AGE SPECIFIC DEATH RATE BY SEX
1973-74

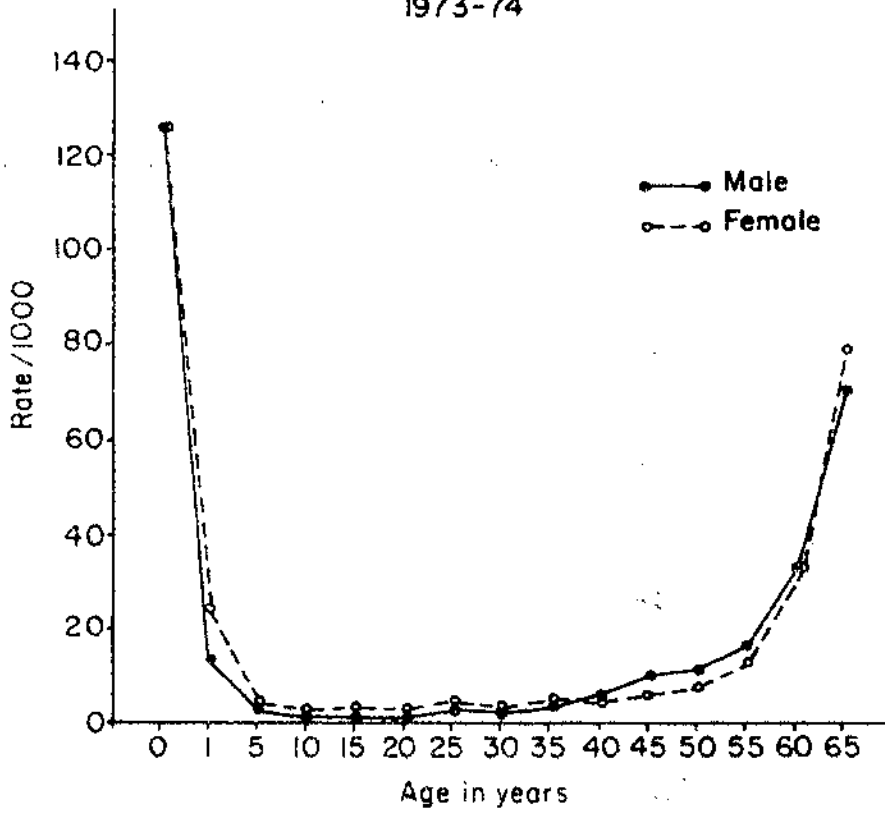


TABLE 5

AGE DISTRIBUTION OF PERSONS WHO DIED DURING MAY 1973 - APRIL 1974 BY MONTHS

Months	< 1	%	1-4	%	5-39	%	40 & above	%	Total	%
May	109	7.0	83	13.0	43	11.0	72	6.7	307	8.4
June	126	8.1	60	9.4	39	9.9	63	5.8	288	7.9
July	92	5.9	62	9.7	38	9.7	88	8.2	280	7.7
August	144	9.2	49	7.7	30	7.7	75	7.0	298	8.1
September	140	9.0	62	9.7	35	8.9	80	7.4	317	8.5
October	206	13.3	66	10.4	37	9.5	105	9.7	414	11.3
November	161	10.3	60	9.4	34	8.7	113	10.5	368	10.1
December	133	8.5	38	6.0	39	9.9	114	10.6	324	8.8
January	130	8.3	35	5.5	27	6.9	115	10.7	307	8.4
February	109	7.0	45	7.1	26	6.6	104	9.7	284	7.8
March	107	6.9	34	5.3	27	6.9	83	7.7	251	6.8
April	102	6.5	43	6.8	17	4.3	65	6.0	227	6.2
Total	1559	100.0	637	100.0	392	100.0	1077	100.0	3665	100.0

FIG. 2: SEASONAL PATTERN OF DEATHS BY DIFFERENT AGE GROUPS AND ALL AGES (MAY 1973-APRIL 1974)

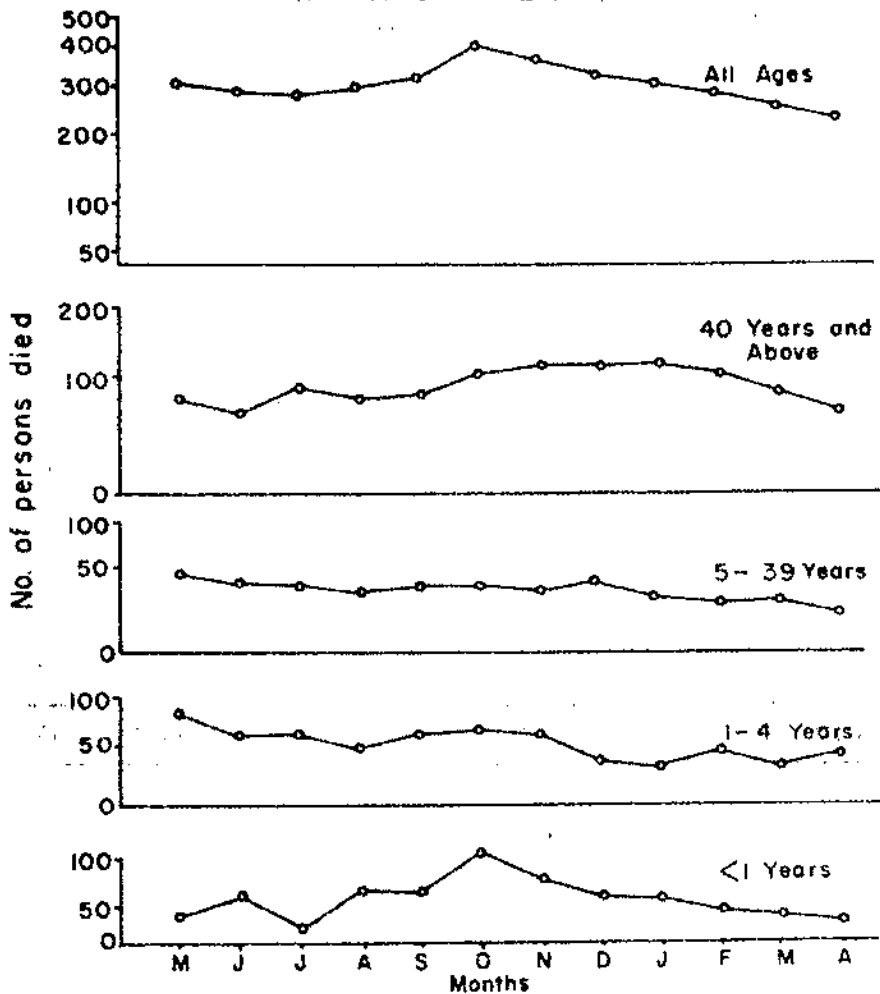


TABLE 6

DISTRIBUTION OF PERSONS WHO DIED FROM MAY 1973 - APRIL 1974
 ACCORDING TO THEIR AGE AT DEATH AND CAUSE AT DEATH

Causes of death	< 1	%	1-4	%	5-14	%	15-39	%	40+	%	Total	%
Fever (all forms)	134	8.6	115	18.1	39	25.0	39	16.5	127	11.8	454	12.4
Acute diarrhoea	12	0.8	8	1.3	4	2.6	2	0.8	18	1.7	44	1.2
Gastrointestinal disease (other than cholera)	41	2.6	210	33.0	30	19.2	20	8.5	247	22.9	548	15.0
Respiratory disease	126	8.1	50	7.8	11	7.1	23	9.7	115	10.7	325	8.9
Measles and smallpox	25	1.6	67	10.5	13	8.3	3	1.3	6	0.6	114	3.1
Accident	5	0.3	61	9.5	20	12.8	19	8.1	24	2.2	129	3.5
Unknown (<i>takuria</i>)	1127	72.3	49	7.7	13	8.3	23	9.7	62	5.8	1274	34.7
Other	89	5.7	77	12.1	26	16.7	78	33.1	476	44.1	746	20.4
Childbirth	-	-	-	-	-	-	29	12.3	2	0.2	31	0.8
Total	1559	100.0	637	100.0	156	100.0	236	100.0	1077	100.0	3665	100.0

APPENDIX B

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

$${}_nq_x = \frac{2n \cdot {}_nM_x}{2+n \cdot {}_nM_x}$$

$${}_np_x = 1 - {}_nq_x$$

$${}_nd_x = l_x \cdot {}_nq_x$$

$$l_{x+n} = l_x - {}_nd_x$$

$$L_{nx} = \frac{n(l_x + l_{x+n})}{2}$$

$$L_0 = 0.3l_0 + 0.7l_1$$

$$L_{65+} = l_{65+} \cdot \text{Log } l_{65+}$$

Assumed

$$T_x = \sum_{65+}^X L_{nx}$$

$$e_0^x = \frac{T_x}{l_x}$$

TABLE 7

AVERAGE LIFE EXPECTANCY a Q_x AT SPECIFIED AGES BY SEX
(BASED ON 1973 - 74 DEATH REPORTS)

Ages	Males	Females	Both
0	51.9	49.8	50.8
1	58.4	55.9	57.0
5	57.1	56.8	56.8
10	52.9	52.7	52.7
15	48.2	47.9	47.9
20	43.4	43.6	43.3
25	38.7	39.1	38.7
30	34.1	34.9	34.4
35	29.5	30.5	30.5
40	25.1	26.1	25.5
45	20.8	21.8	21.3
50	16.8	17.3	17.0
55	12.7	12.9	12.8
60	8.6	8.6	8.6
65+	4.7	4.7	4.7

TABLE 8

DISTRIBUTION OF WOMEN WITH PREGNANCY OUTCOME DURING MAY 1973 - APRIL 1974
ACCORDING TO THEIR AGE AND OUTCOME OF PREGNANCY

Age	Miscar- riage	Still birth	Twin still birth	Male live birth	Female live birth	Male twin live birth	Female twin live birth	Male & female twin live birth	Male twin live birth and still birth	Female twin live birth and still birth	Total
10-14	11	9	-	64	46	1	-	-	-	-	131
15-19	119	62	2	945	806	3	3	1	3	1	1945
20-24	158	103	-	1608	1614	3	6	2	3	2	3499
25-29	154	73	1	1471	1437	8	12	7	3	4	3170
30-34	120	93	1	1237	1194	6	7	8	2	-	2668
35-39	100	65	2	633	645	4	8	8	2	-	1467
40-44	42	14	-	189	198	1	1	1	1	-	447
45-49	11	2	-	38	42	1	-	-	-	-	94
Total	715	421	6	6185	5982	27	37	27	14	7	13421

Male live birth 6280

Female live birth 6090

Total live birth 12370

Sex ratio at birth 103.1

Among the live births, 51 percent were males yielding a sex ratio of 103 males per 100 females. One hundred and eighteen multiple births occurred during this period, resulting in a ratio of 114 pregnancies for every multiple birth. Stillbirths occurred at a rate of 29.6 per thousand pregnancies, yielding a ratio of one stillbirth for every 27.2 live births. The actual number of miscarriages is not known and underestimated, since very frequently early pregnancies were not identified. During the one year period 715 miscarriages were recorded yielding a ratio of one miscarriage per 18.8 pregnancies.

Table 9 and Figure III show the monthly distribution of pregnancy outcomes. This table indicates that the peak period of pregnancy termination occurred during the September to December period. This pattern was generally maintained among all pregnancy orders. Overall, most of the conceptions occurred during the spring and early summer (February-April). The probable explanations of higher conception during the period referred to here were noted by Chowdhury and Aziz (1982b).

Table 10 shows the age-specific pattern of fertility. The general fertility rate was 164.1 births per thousand women aged 10-49 years. The maximum births occurred in the age group 20-24 years. The highest age specific rate was 369.0 births per thousand women and occurred in the 25-29 year age group.

Table 11 shows that the gross reproduction rate (GRR) was 3.49 and that the net reproduction rate (NRR) was found to be 2.62. The mean length of generation was 28.54 years and the intrinsic rate of natural increase was 3.4 percent per year.

Table 12 shows the rates of in-and out-migrations separately by age and sex. The out-migration rate was higher than in-migration rate for ages 0-19 years. The out-migration rate was lower than in-migration rate in ages 20-44 years except the age group 25-29. Amongst the older group of above 50 years the out-migration rate was almost similar to in-migration rate.

In ages 0-24 years the male in-migration rate was lower than females, but in ages 25-59 years the reverse was true. Above the age of 60, the female in-migration rate was higher than the male in-migration rate.

The out-migration rate of children aged four and under was slightly higher for male than for female children. In ages 5-24 years, the out-migration rate for females exceeded that for males, but in ages 25-64 years the out-migration rate for males was higher than for females. In the age group 65 and over, the out-migration rate for females was higher than for males. Overall, the rate of out-migration was significantly higher than the rate of in-migration rate and the female in-migration and out-migration rates were higher than those for males.

TABLE 9

DISTRIBUTION OF WOMEN WHO EXPERIENCED PREGNANCY DURING MAY 1973 - APRIL 1974
ACCORDING TO THE MONTH OF OUTCOME

Month of outcome	Distribution of pregnancies (Number)				All pregnancies	Distribution of pregnancies (Percent)				All pregnancies
	1	2-3	4-7	8+		1	2-3	4-7	8+	
1973 May	141	231	357	182	911	7.0	6.4	6.7	7.4	6.8
June	156	238	357	177	928	7.7	6.6	6.7	7.1	6.9
July	171	269	352	158	950	8.5	7.5	6.6	6.4	7.1
August	206	271	462	200	1139	10.2	7.6	8.6	8.1	8.5
September	199	325	423	241	1188	9.8	9.1	7.9	9.8	8.8
October	248	439	636	264	1587	12.2	12.3	11.9	10.7	11.8
November	190	430	577	248	1445	9.4	12.0	10.8	10.1	10.8
December	169	348	516	230	1263	8.4	9.7	9.6	9.3	9.4
1974 January	152	301	441	240	1134	7.5	8.4	8.2	9.8	8.4
February	118	269	447	183	1017	5.9	7.5	8.3	7.4	7.6
March	137	242	423	186	988	6.8	6.8	7.9	7.6	7.4
April	133	218	366	154	871	6.6	6.1	6.8	6.3	6.5
Total	2020	3581	5357	2463	13421	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 1973 - APRIL 1974)

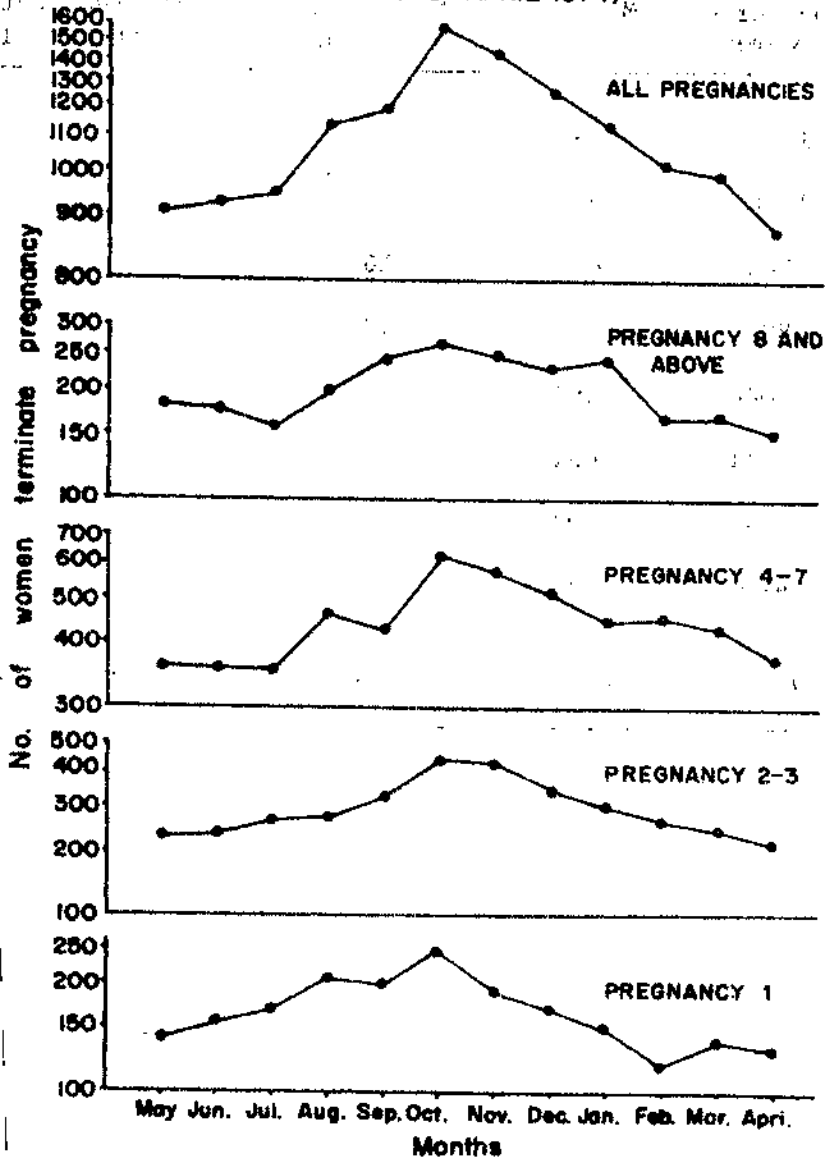


TABLE 10

DISTRIBUTION OF AGE SPECIFIC FERTILITY RATE PER 1000 WOMEN
(MAY 1973 - APRIL 1974)

Age of mother (corrected)	Number of women	Male live birth	Female live birth	Total live birth	Rate per 1000
10-14	19132	66	46	112	5.85
15-19	12987	955	814	1769	136.21
20-24	9403	1619	1630	3249	345.53
25-29	8047	1497	1472	2969	368.96
30-34	9046	1259	1216	2475	273.60
35-39	6811	651	669	1320	193.80
40-44	5746	193	201	394	68.57
45-49	4204	40	42	82	19.51
All child bearing ages	75376	6280	6090	12370	164.11

TABLE 11

CALCULATION OF GROSS AND NET RATES AND INTRINSIC RATE OF NATURAL INCREASE (MAY 1973 - APRIL 1974)

Age	Female population	Live birth female	Daughters per 1000	Pivotal age	Proportion surviving the pivotal age	Women surviving at given age	Person years
10-14	19132	46	2.40	12.5	.78086	1.87	23.37
15-19	12987	814	62.68	17.5	.77695	48.70	852.25
20-24	9403	1630	173.35	22.5	.76576	132.74	2986.65
25-29	8047	1472	182.93	27.5	.75703	138.48	3808.20
30-34	9046	1216	134.42	32.5	.73947	99.40	3230.50
35-39	6811	669	98.22	37.5	.72742	71.45	2679.37
40-44	5746	201	34.98	42.5	.71192	24.90	1058.25
45-49	4204	42	9.99	47.5	.69227	6.92	328.70
Total			698.97			524.46	14967.29
5 X Total			3494.85			2622.30	74836.45
Gross reproduction rate			3.5				
Net reproduction rate			2.6				
Mean length of generation			28.5				
Intrinsic rate of natural increase			3.4%	per year			

TABLE 12

MIGRATION RATE FOR THE YEAR 1973 - 1974 BY AGE AND SEX

	Male (%)		Female (%)		Total (%)		Net (%)		Total
	In	Out	In	Out	In	Out	Male	Female	
0-4	1.27	1.62	1.31	1.51	1.29	1.57	-0.35	-0.20	-0.28
5-9	0.43	1.17	0.44	1.18	0.43	1.17	-0.74	-0.74	-0.74
10-14	0.96	1.33	1.12	3.31	1.04	2.29	-0.37	-2.19	-1.25
15-19	1.39	2.07	5.67	8.21	3.30	4.80	-0.68	-2.54	-1.50
20-24	2.04	3.02	7.59	4.25	4.87	3.55	-0.98	+3.34	+1.32
25-29	4.17	4.72	2.06	2.10	2.92	3.16	-0.55	-0.04	-0.24
30-34	3.22	2.59	1.20	1.20	2.04	1.78	+0.63	0.00	+0.26
35-39	2.79	2.09	0.70	0.63	1.71	1.33	+0.70	+0.07	+0.38
40-44	1.50	1.13	0.68	0.75	1.12	0.95	+0.37	-0.07	+0.17
45-49	1.33	1.50	0.40	0.86	0.90	1.20	-0.17	-0.46	-0.30
50-54	1.21	1.10	0.85	0.97	1.05	1.04	+0.11	-0.12	+0.01
55-59	1.06	0.97	0.70	0.76	0.89	0.87	+0.09	-0.06	+0.02
60-64	1.00	1.13	1.17	0.95	1.07	1.05	-0.13	+0.22	+0.02
65 +	0.92	0.75	1.14	1.37	1.01	1.01	+0.17	-0.23	0.00
Total	1.45	1.76	1.99	2.50	1.72	2.12	-0.31	-0.51	-0.40

Negative sign indicates net out migration from the area and conversely positive sign indicates net in-migration.

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