DEMOGRAPHIC CHARACTERISTICS OF A POPULATION LABORATORY IN RURAL EAST PAKISTAN

by

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ABSTRACT

One of the major difficulties encountered in assessing the severity of population problems in developing countries and in evaluating the effects of programs and policies on population trends is the lack of accurate data on a variety of demographic variables. Efforts to supply the needed information have generally met with only partial success. However, the Cholera Research Laboratory in Dacca, East Pakistan, has developed a highly accurate data collection system for a densely settled rural population. This paper presents some of the demographic data produced by this system. The population shows a very young median age (16.3), a high birth rate (45 to 47 per 1,000 population in the three years under review), and a moderate death rate (15 to 17). With a rural population density of 2,000 per square mile, the pressures generated by the growing population are intense.

INTRODUCTION

The Pakistan-SEATO Cholera Research Laboratory was established in Dacca, East Pakistan in 1960 to develop, improve and demonstrate measures for the prevention and eventual eradication of cholera. An essential component of this program is the conduct of controlled field trials of cholera vaccines. Villages in Matlab Thana, Comilla District, located in the south central area of East Pakistan, were selected for these studies. The basic design of these field trials involves taking a complete census in the villages under study and assigning an identifying census number to every individual. The vaccines to be tested are randomly assigned to the population and administered by vaccine teams. In order to detect all cholera cases, field workers visit every household daily to make inquiries about the occurrence of acute diarrheal illnesses. A field hospital has been established in a central location with a speedboat ambulance service to provide treatment for all severe, acute diarrheal cases.

The field trials began in 1963 and initially covered 23 villages with a population of

28,000 individuals. In 1964, the trial was expanded to include an additional 35 villages and covered a total population of 60,000. The area was further expanded in 1966 to cover an additional 74 villages, giving a total population of 112,000; in 1968 an additional 111 villages were added, giving a total population of 225,000 persons under surveillance. A field staff of more than 350 maintains the daily household surveillance over this population.

Since the expansion of the area in March 1966, the field staff have been maintaining a regular registration of all births, deaths, and migrations, in addition to carrying out their regular surveillance for acute diarrheal diseases. This paper summarizes the methods of data collection and describes some of the demographic characteristics of the 112,000 persons who have been under study since March 1966.

THE STUDY AREA

Matlab is located in the deltaic area of East Pakistan, which is intersected by innumerable tidal rivers and canals, branches of the large rivers, Ganges, Brahmaputra and Meghna. (See map.) The climate is subtropical, with the Tropic of Cancer passing through the area. There are three seasons: monsoon, cool-dry, and hot-dry. Most of the annual average rainfall of 85 inches falls during the monsoon, which extends from June through September. It rains almost daily and most of the area is flooded. This is followed by the cool-dry season, which lasts until February. During this time, there is little rain, the days are pleasant and warm, and the evenings cool. The hot-dry season begins in March and ends with the beginning of the monsoon.

The people are almost entirely indigenous Bengalis. Over 80 percent are Muslim. The great majority of the remainder are Hindu. Less than 25 percent of the adults are literate. The principal occupations are agriculture and fishing, the latter being mainly a Hindu occupation. Most of the farmland is given to rice, the dietary staple, and jute, the cash crop.

Villages have an average population of 1,000 persons. Each village is divided into many

baris, a unit of two or more patrilineally-related families. Each family has its own one- or two-room house with a mud floor, jute stick walls, and a thatched grass or galvanized iron roof. The houses in baris are arranged around a central courtyard. The average population density exceeds 2,000 per square mile. During the monsoon, when most of the land is under water, the actual population density is much higher. This area has no roads; internal communication is accomplished primarily by country boat or on foot. A few motorized passenger launches provide transport to Dacca and other large towns.

Besides the cholera research program, modern medical facilities consist of a rural health center with one physician to provide dispensary services to the 300,000 people in Matlab Thana.

METHODS

The census was taken in March and April of 1966 by four teams, each consisting of two trained field workers. The workers went from house to house collecting the basic information from each family on a simple form. For this
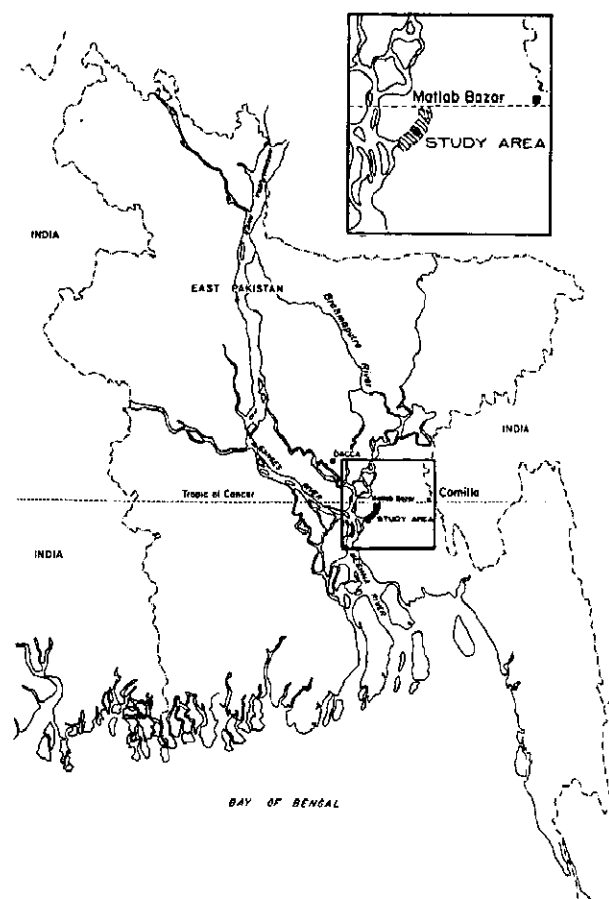
study, a family was defined as a hearth unit, i.e. a group which eats together. There were commonly several patrilineally-related families living around a single courtyard in a bari.

Families were identified by the name of the family head and the location. The family members were listed by name, age and sex. Efforts were made to obtain reasonably accurate ages by beginning with the age of the youngest child in the family and then asking the ages of the older children and of the parents and other members. The census workers made an effort to correct any obvious discrepancies in the ages reported by the informants. No effort was made, however, to verify the reported ages by such means as dating of historical events.

At the completion of this census, census books were made up in triplicate from the family census sheets arranged in geographical order. Every individual was assigned the village census number and an individual serial number within the village. One copy of the census book was returned to the field worker who used it to issue individual family census cards to every family. At this time any discrepancies which were noted by the field workers were reported to the central office and corrected.

Surveillance for births and deaths is maintained by several levels of workers. A local female resident of each village visits each household daily and inquires about births and deaths. A male field assistant supervises from 3 to 5 of these lady field workers. These men, with the equivalent of a high school education (matriculates), visit each family an average of once weekly and register all births, deaths, and migrations on standard forms. Supervision of this phase of the work is maintained by Sanitary Inspectors who visit each household approximately twice a month to check on the completeness of birth and death registration. In turn, these workers are supervised by the Field Surveillance Supervisor and his deputy who are responsible for the coordination of the field work.

DEFINITIONS

The census included only regular residents of the villages under study. It excluded temporary visitors or guests who were present at the time the census was taken. An individual who had a regular job outside the village but returned to his village home a minimum of one time a month was considered a resident. Likewise, migratory workers, such as fishermen, who were gone for six months of the year but returned for the remaining six months were also considered as residents. An individual who regularly lived outside the village and returned to the village to visit less than once a month was not considered a resident.

These definitions also apply to the registration of births and deaths in this area. All births occurring to individuals included in the census or to new residents of the area, regardless of the places of occurrence of the births, are registered and included in the calculation of the birth rates to the study population. Births occurring within the study villages to temporary visitors are registered but excluded from the calculation of birth rates. Similarly, all deaths among residents included in the census or new residents are registered, regardless of the place of occurrence, for the calculation of death rates. Deaths occurring within the study area to non-residents are registered but excluded in the calculation of death rates.

All pregnancy terminations, including stillbirths (7 to 9 months gestation, based on the mother's report) and abortions (less than 7 months) are registered. The birth reports include the pregnancy history of the mother.

In the registration of migrations, an emigrant is an individual originally listed on the census as a resident, but who has permanently moved out of the study villages. Likewise, an immigrant is an individual who has permanently moved into the study villages from outside the area. Permanent migrations between the 132 villages within the study area are noted by the field workers but are not classified as migrations into or out of the area. "Permanent" is defined as a change of residence for six months or longer. There is no registration of transient visitors.

QUALITY OF THE DATA

Because of the intensive and regular house-to-house surveillance and the close supervision of the field staff, the data on events that can

be directly verified, such as a birth, death or migration, are highly reliable. On the other hand, data based on the memory of a respondent, such as age or pregnancy history, are subject to a wide margin of error. This is exemplified by a not uncommon response of the villager when asked his age: "You tell me." The assumption is that since the enumerator is educated, he should know better than the villager himself! Efforts were made to obtain reasonable estimates of age from the villagers, and these reported data are used in this study without further adjustments.

RESULTS

There were 111,748 persons in the 132 study villages at the time of the 1966 census. Figure 1 and Table 1 show the distribution of the population by age and sex. This was a relatively young population; 48 percent were under age 15, while only 11 percent were over age 50. The median age was 16.3

The sex ratio presents an interesting pattern. There was a slight preponderance of males in the age groups under 20 years. In the age groups 20-34 years, there was a large excess of females. Again, in the age groups 35 years and over there was an excess of males. The relative lack of young adult males reflects the emigration of young men to urban areas in search of work.

FIGURE 1. AGE PYRAMID OF THE STUDY POPULATION, PAKISTAN-SEATO CHOLERA RESEARCH LABORATORY: APRIL, 1966
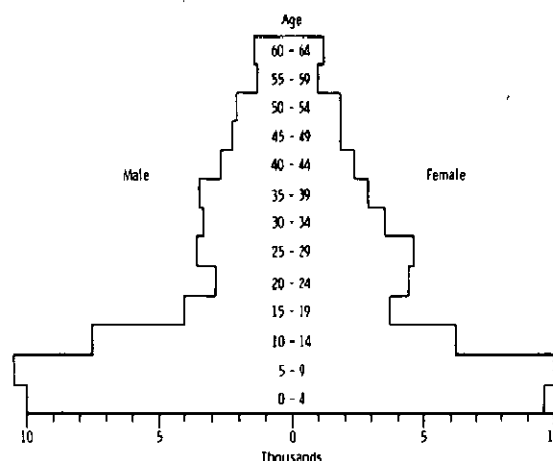
A comparison of age groups 0-4 and 5-9 suggests that the number of children under 5 years of age was undercounted in the census. This was probably due to overstatements of age, rather than to failure to count some children at all. A special study of the census count revealed that the number of children under 1 year of age was about 20 percent below the correct number. The proportionate undercount would, of course, be smaller for the population under 5 years of age.

To calculate vital rates, an adjusted midyear population was used. This was obtained for each successive year by adding half the births and half the immigrants and subtracting

TABLE 1. DISTRIBUTION OF THE POPULATION BY AGE AND SEX: APRIL 1966

Age	Number			Percent			Sex Ratio [a]
	Total	Male	Female	Total	Male	Female	
TOTAL	111,748	57,149	54,599	100.0	100.0	100.0	104.6
0-4	19,582	9,913	9,669	17.5	17.3	17.7	102.5
5-9	20,588	10,581	10,007	18.4	18.5	18.3	105.7
10-14	13,692	7,456	6,236	12.3	13.0	11.4	119.6
15-19	7,873	4,042	3,831	7.0	7.1	7.0	105.5
20-24	7,148	2,889	4,259	6.4	5.1	7.8	67.8
25-29	8,099	3,456	4,643	7.2	6.0	8.5	74.4
30-34	6,922	3,343	3,579	6.2	5.8	6.6	93.4
35-39	6,296	3,424	2,872	5.6	6.0	5.3	119.2
40-44	5,019	2,757	2,262	4.5	4.8	4.1	121.9
45-49	3,980	2,228	1,752	3.6	3.9	3.2	127.2
50-54	3,818	2,057	1,761	3.4	3.6	3.2	116.5
55-59	2,299	1,322	977	2.1	2.3	1.8	135.3
60-64	2,612	1,383	1,229	2.3	2.4	2.3	112.5
65 and over	3,745	2,268	1,477	3.4	4.0	2.7	153.5
Not reported	75	30	45	0.1	0.1	0.1	. . .

[a] Males per 100 females

half the deaths and half the emigrants who were registered in the year. The infant mortality rate was calculated by using the number of live births as the denominator.

Table 2 summarizes the total number of births, deaths, and migrations for three years. In this study, the "demographic year" extends from May to April, rather than conforming to the calendar year, because of the phasing of the cholera research. The crude birth rate has fluctuated between 45 and 47 per thousand, while the crude death rate has been between 15 and 17 per thousand, giving a crude rate of natural increase ranging from 2.9 to 3.2 percent per year.

Complete data on migration are now available only for the second year of observation (1967-68). The count for the first year is incomplete because there were no records of changes in residence for those entering or leaving before the census was taken. The count for the third year is incomplete because when this report was written, insufficient time had elapsed to determine the migration status of some of those who had recently joined or recently left the study population.

The age- and sex-specific mortality rates for 1967-68 are summarized in Table 3. The infant mortality rate was 125 per 1,000 live births. The death rate fell sharply to 29 per 1,000 among children ages 1-4 and reached the lowest level of 2 per 1,000 in the 10-19 age group. The death rates remained low until age group 40-49 and then rose rapidly with increasing age.

TABLE 3. DEATH RATES BY AGE AND SEX: 1967-68 (per 1,000)

Age	Total	Male	Female
All ages	16.6	16.5	16.7
Under 1	125	127	124
1-4	29	25	34
5-9	5	5	5
10-19	2	2	3
20-29	4	4	4
30-39	4	4	5
40-49	9	10	8
50-59	19	19	18
60-69	33	32	34
70 and over	100	97	112

The number of children in this population is so great and their mortality is so high that more than half of all deaths (56.7 percent) are to children under 5 years of age: 34.3 percent are to infants (under 1 year of age) and 22.4 percent are to children 1-4 years old.

The mortality rates by sex present some interesting patterns. The infant mortality rate was slightly higher for males than females, consistent with observations in most areas of the world. Among children 1-4 years old, however, the mortality rate for females was 36 percent higher than for males. This is a consistent pattern since, in the preceding year, the female mortality rate was 50 percent higher than the male rate in this age group. This mortality differential is apparently due to the fact that parents are more cautious about the health of sons. Females also had higher mortality in the childbearing years. In the age group 15-39, the average mortality rate among females was 4.3 per 1,000, compared to 3.5 per 1,000 for males. This probably reflects high maternal mortality; an independent

TABLE 2. SUMMARY OF VITAL RATES: 1966-69

	1966-67		1967-68		1968-69 b	
	Number	Rate per 1000	Number	Rate per 1000	Number	Rate per 1000
Midyear population	112,711	....	114,561	....	116,500	....
Live births	5,308	47.1	5,207	45.4	5,514	47.3
Deaths	1,694	15.0	1,906	16.6	1,767	15.2
Immigrations	a	a	4,009	35.0	a	a
Emigrations	a	a	5,415	47.3	a	a
Crude rate of natural increase (percent)	3.2		2.9		3.2	
Net increase (percent)	a		1.7		a	

a Not available
b Preliminary estimates

study in this population by Melita Gesche and Shamsa Ahmad has shown the maternal mortality rate to be about 7 per 1,000 live births.

A more detailed analysis of fetal, neonatal, and infant mortality is given in Table 4. Among 5,614 pregnancies reported as terminated, including 42 sets of twins, 446 terminated with a fetal death. The duration of gestation in these fetal deaths is based on the mother's report; however, it is felt that the registration of stillbirths is relatively complete. The stillbirth rate was 40.2 per 1,000 pregnancies. The registration of pregnancies terminating before 7 months of gestation is obviously incomplete since essentially no terminations were reported before 3 months. Among the 220 abortions reported, 15 were admitted as induced abortions, all for illegitimacy. Because of the conservative nature of the Muslim society, there is little information about the prevalence of induced abortion.

TABLE 4. FETAL, NEONATAL, AND INFANT
MORTALITY: 1967-68

Fetal Mortality

Event	Number	Rate per 1,000 pregnancies
Pregnancies terminated	5,614	....
Abortions (under 7 months)	220	39.2
Stillbirths (7-9 months)	226 a	40.2
Total fetal deaths	446	79.5

Infant Mortality

Event	Number	Rate per 1,000 live births
Live births	5,207	....
Deaths age 0-7 days	225	43.2
Deaths age 8-29 days	128	24.6
Total neonatal mortality	353	67.8
Deaths age 1-12 months	300	57.6
Total infant deaths	653	125.4

a Includes four sets of twins with one stillbirth in each set

The neonatal mortality rate was 67.8 per 1,000 live births, with the majority of neonatal deaths occurring within the first seven days following birth. Preliminary surveys suggest that neonatal tetanus may account for as

much as 50 percent of the neonatal deaths. A more detailed analysis of fetal and neonatal mortality in this population by A. K. M. A. Chowdhury has shown that there is a definite correlation of fetal and infant mortality with pregnancy order. Both the fetal and infant mortality rates were highest for the first pregnancy. The infant mortality rate fell and remained low with subsequent pregnancies, while the fetal mortality rate, after remaining low for the second through the fourth pregnancies, again rose with higher order pregnancies.

There is a striking seasonal pattern of pregnancy terminations. This is illustrated in Table 5. Thirty-five percent of the pregnancies terminated in the months of October through December, suggesting that a higher proportion of conceptions take place during January through March. A similar seasonal pattern has been observed in other areas of the subcontinent. Although the cause for this seasonal pattern has not been determined, one might speculate that climatic and sociological factors play a role. January and February are the coldest months of the year. Since this period follows the harvest but precedes spring planting, there is a relative abundance of food, but less work to engage this primarily agrarian population.

TABLE 5. SEASONAL PATTERN OF PREGNANCY
TERMINATIONS: 1967-68

Month of Termination		Percent of Pregnancies Terminated
Total		100.0
1967	May	7.2
	June	6.7
	July	6.0
	August	6.8
	September	7.5
	October	12.6
	November	11.2
	December	11.4
1968	January	8.7
	February	8.0
	March	7.8
	April	6.1

Table 6 summarizes the age-specific fertility rates for the first two years of observation. The fertility rate was highest, averaging 332 per 1,000 in the age group 20-24 years. In the second year, the fertility rates were slightly lower in the age groups over 25,

TABLE 6. AGE-SPECIFIC FERTILITY RATES:
1966-67 and 1967-68

Age of Mother	Live birth rate per 1,000 women		Live birth rate per 1,000 married and probably fecund women
	1966-67	1967-68	1967 Calendar Year
10-14	8.6	8.6	79.6
15-19	238.6	232.3	256.1
20-24	331.4	333.6	327.3
25-29	306.9	297.3	310.7
30-34	248.8	204.3	246.8
35-39	138.5	127.9	188.5
40-44	50.0	44.2	106.9
45-49	15.4	19.3	84.8
Total fertility rate [a]	6.69	6.34	. . .
Gross reproduction rate [a]	3.31	3.12	. . .

[a] Per woman

although it is impossible in only two years
to determine if a definite trend is developing.
The gross reproduction rate was 3.31 for
1966-67 and 3.12 for 1967-68.

A special survey was carried out in January
1968 among all ever married women in the
Matlab area to determine more precisely
those that were currently married and probably
fecund—defined as either regularly men-
struating, lactating, or pregnant. Among the
30,155 ever married females, 23,740 were
found to be currently married and 19,930 were
classified as married and probably fecund.
The remaining married women had either not
yet reached menarche, or had passed the
menopause. Using only the married and
probably fecund women as a denominator,
Table 6 also illustrates the age-specific
fertility rates for this segment of the female
population for the 1967 calendar year. The
fertility rate was highest for women ages
20-24. The major differences in the age-
specific fertility rates are seen at the extremes
of age, since this analysis excludes unmarried
and subfecund women.

Table 7 summarizes the patterns of migration
by age and sex for 1967-68. Overall, there
was a net annual emigration of 1.23 percent;
this was primarily due to the emigration of
males, averaging over 5 percent annually.
More than half the emigration of males was
for work, as indicated by the emigration rates
ranging from 10 to 14 percent in the age

groups 15-29 years. The large immigration of
males, averaging 6 percent in this same age
group, primarily represented men classified as
"returning home" largely because of failure to
find permanent employment outside the

TABLE 7. MIGRATION RATES BY AGE AND SEX:
1967-68

Age	Male		Female	
	In Percent	Out Percent	In Percent	Out Percent
All ages	3.4	5.4	3.6	4.1
0-4	2.6	2.9	2.8	3.2
5-9	2.3	2.7	2.0	2.6
10-14	3.2	5.2	5.1	8.0
15-19	6.3	13.8	14.5	11.6
20-24	6.0	12.0	4.8	5.0
25-29	6.3	9.8	3.3	3.4
30-34	4.7	7.1	2.3	2.2
35-39	3.3	6.3	1.4	1.7
40-44	3.4	5.5	1.2	1.5
45-49	2.4	4.2	1.0	2.0
50-54	2.5	3.0	1.3	1.7
55-59	1.4	2.4	1.0	2.1
60-64	1.7	1.7	1.5	1.4
65 and over	1.0	1.7	2.7	1.7

village. Among females, both the in- and out-
migration rates rose abruptly in the 10-14
year age group, and peaked in the 15-19 year
age group. This reflects the cultural pattern
of marriages at a young age, with the woman
going to live with her husband's family.

DISCUSSION

The cholera vaccine field trials conducted by
the Pakistan-SEATO Cholera Research
Laboratory require the intensive surveillance
of a large rural population. This daily personal
contact plus the provision of a field hospital
and ambulance service for cholera and acute
diarrheal disease, has resulted in the
development of excellent rapport with the
villagers. Thus, the field trial provides a unique
situation for the regular collection of detailed
information with a high degree of reliability
from a large rural population in East Pakistan.
The vaccine studies and provision for cholera
treatment have some effect on the morbidity
and mortality in this population. It has been
estimated that the cholera vaccine studies
and the treatment center reduce the crude
death rate by about 1 to 1.5 per 1,000 per

year. The effect of epidemic diseases in this population can be most easily demonstrated with smallpox. The rise in the crude death rate from 15.0 per 1,000 in the first year to 16.6 in the second year was due almost exclusively to a smallpox epidemic in the spring of 1968.

The data available from these demographic studies provide a graphic illustration of the population problem facing the subcontinent. At the current growth rate of 3.2 percent annually, the population can be expected to double in a little over 20 years; however, with a continuing high birth rate, low death rate, and the broad-based age structure bringing an increasing number of females into the reproductive ages every year, an accelerating growth in numbers of people can be predicted in the absence of any intervening factors.

Pakistan has pursued a vigorous family planning program on a nationwide scale since 1965. The program has disseminated the knowledge that family planning methods are available and effective and has succeeded in breaking down some of the taboos, so that the topic of family planning can be brought up for discussion even in the remotest villages. The program has been active in this study population since 1966, with a family planning clinic staffed by a graduate family planning officer, a lady family planning visitor trained to insert the intrauterine device, and about 100 supporting staff, including village organizers dispensing conventional contraceptives and motivating the people to accept the IUD or vasectomy.

The data from these demographic studies depict some of the problems facing the family planning program in this tradition bound, largely illiterate population which has virtually no modern medical facilities available (except for the treatment of cholera and diarrheal diseases). For the women, marriage generally takes place around puberty, usually between the ages of 13 and 16, and the proportion ever marrying is close to 100 percent. Thus, they are exposed to pregnancy throughout their entire reproductive years. For men, marriage usually occurs between ages 21 and 25. Since life table analysis of these demographic data indicates that the newlywed girl may expect to survive for 49 more years after marriage, as compared to only 41 years for her husband, the end result of this age differential at marriage is a large excess of widows in the older age groups. In fact, in the 1968 survey of all ever-married women, it was found that 67 percent of the women over age 50 were widows. Since the only means of support for these women is their children, specifically their sons, the prospect of widowhood in their old age probably provides a strong motivation for young girls to have a large family for social security purposes. This is no doubt reinforced by the high infant and childhood mortality which must be personally evident to the majority of the women, since most of them will have seen one or more of their own children die.

It is not possible to cover all of the implications of the demographic features of this study population in this brief report, which was prepared primarily to provide an overview of the population laboratory that has been established in rural East Pakistan. Vital registration and special demographic studies will continue over the next several years in a program jointly supported by USAID and the Center for Population Research, National Institute of Child Health and Human Development, NIH, and in collaboration with the Institute of Statistical Research and Training of Dacca University.