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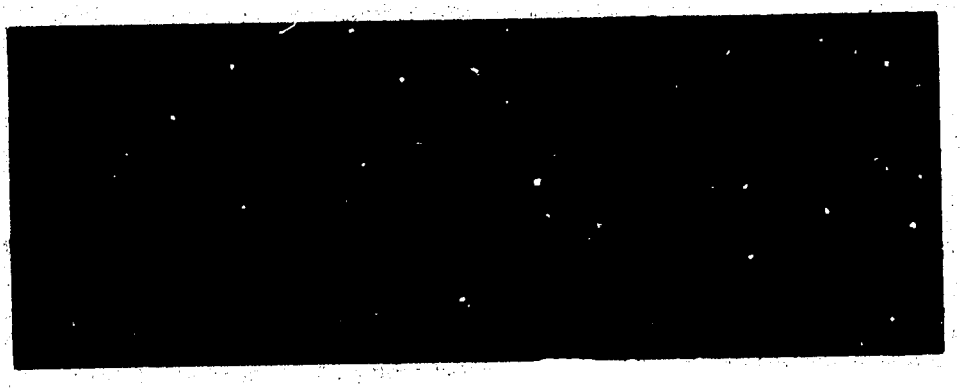
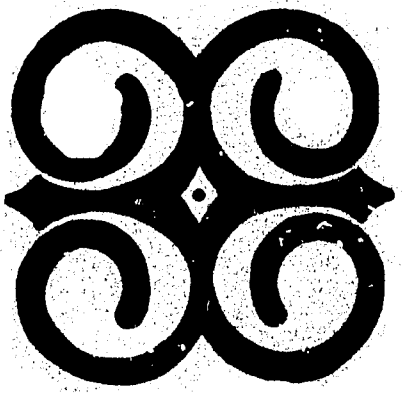


Danfa Comprehensive Rural Health and Family Planning Project, Ghana



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ESTIMATES OF INDICES OF FERTILITY FROM REGISTRATION DATA

Monograph Series, Number 3

DANFA COMPREHENSIVE
RURAL HEALTH AND FAMILY PLANNING
PROJECT, GHANA

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FOREWORD

The Danfa Comprehensive Rural Health and Family Planning Project is a teaching, research, demonstration and service programme initially developed by the Department of Preventive and Social Medicine of the Ghana Medical School in 1965 and implemented under contractual agreement with the School of Public Health at the University of California, Los Angeles, and the Agency for International Development in 1970. The eight year project is closely associated with other Ghanaian agencies and institutions such as the Ministries of Health, Social Welfare, and Finance, the Ghana National Family Planning Programme, and other University of Ghana departments.

The Ghanaian institutions have primary authority and responsibility for project administration. Ghanaian staff are hired by the institutions at prevailing terms of employment. All service costs are borne by the Government of Ghana as well as some of the training and evaluative costs. UCLA/AID are responsible for most of the research costs.

The project includes a longitudinal study of approximately 50,000 rural inhabitants, 10-50 miles from Accra. The project area has been divided into four sub-areas to investigate alternative methods of delivering health and family planning services, summarised in the chart below.

	Service Provided			
Area	Comprehensive Health Care	Health Education	Family Planning	Standard Health Services
I	Yes	Yes	Yes	Yes (equivalent)
II	No	Yes	Yes	Yes
III	No	No	Yes	Yes
IV	No	No	No	Yes

One of the principal goals of the project is to provide information about project activities and findings to concerned agencies on an ongoing basis to assist in health planning. A project monograph series has been developed to aid in this information sharing process, and we hope that the data contained in these papers, although often preliminary in nature, will prove useful to those involved in the project and to others interested in obtaining current information on rural health projects in developing countries.

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This paper is one of a series of vital events and demography articles which report on data obtained from vital events registration and baseline demographic surveys conducted for use in the Danfa Project and by interested agencies and institutions in Ghana. The data presented here are, however, preliminary, and subject to modification after further analysis. Updated data will be issued as they become available.

Acknowledgement

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This paper was originally prepared for the Inaugural Conference of African Demographers, Ibadan, 10-14 May, 1974.

Estimates of Indices of Fertility From Registration Data

Introduction

Despite the efforts to extend and improve registration, it is likely that in many cases the data will be seriously defective for a long time to come. The attempt to obtain as much profit as possible from existing registration is, however, desirable and justified. Brass (1969) suggests that the most effective way this can be done is by collection of further information about the maternity history of the mother at the time of registration or notification of birth, particularly about the number of her children ever born and surviving. An experimental project, initiated at Danfa, collects this information from mothers at the time of registration. This paper is concerned with an attempt to derive indices of fertility from this data. It deals mainly with the estimation of fertility using some of Brass's techniques, and attempts to bring together various estimates of fertility which are possible, with the use of data from other project sources. Some important research problems have been encountered in analysing the data, and suggestions as to possible solutions have been made. However, further work is needed on the applications of some of the suggested solutions for the full range of error components to be investigated.

1. Measures of Fertility from Registration Data

Several indices of observed and estimated fertility from vital registration records and fertility survey data are demonstrated in this section. These include the average number of children per mother, the average number of children per woman, the age specific fertility rates, total fertility rates, the gross reproduction rates, relative age specific fertility rates, age specific order birth rates, the crude birth rates, the general fertility ratios and the child-woman ratios. The analysis of age patterns of fertility is also undertaken with a view to the classification of the age specific fertility rates according to different patterns, as well as to study the age structure of fertility in the project areas.

i) Average Number of Children Ever Born per Mother and per Woman

Brass (1969) maintains that the order of current births is related to fertility. He believes that the mean number of children ever born (excluding the current one) to mothers giving birth in a particular period, may be an index of fertility not depending directly on the completeness of registration. Indices of this type have been used by El-Badry (1967) for studies of differentials in Bombay; however, the relationship of such measures to the standard ones are far from simple. The mothers of a given age who bear a child in a year are generally not a random sample of the mothers of that age in the population. Table 1 shows the percentage distribution of women and mothers in the first twelve months of observation.

There are obvious biases such as the omission of women who have become sterile at a younger age, and the over-representation of those with above-average fertility as well as more subtle ones. Among the latter are variations in specific fertility at a given age with length of marriage, and the

Table 1

Percentage Age Distribution of Women and Mothers*

in the 15-49 Age Group by Area

Age Group	Area I		II		III		IV	
	Women	Mothers	Women	Mothers	Women	Mothers	Women	Mothers
15-19	25.1	11.8	21.4	10.4	20.8	13.1	24.8	9.9
20-24	18.7	24.7	17.4	28.7	18.6	23.4	17.7	22.7
25-29	13.2	18.9	15.0	23.6	17.1	24.0	14.9	26.3
30-34	12.6	19.0	13.8	18.3	14.3	19.6	13.1	20.9
35-39	10.9	15.3	12.6	9.4	11.2	10.0	11.3	12.8
40-44	10.6	6.4	10.2	6.9	9.2	5.6	9.6	6.0
45-49	8.9	3.9	9.6	2.6	8.8	4.3	8.6	1.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Nr.	2462	491	2261	490	3038	739	2889	604

*The percentage distribution of mothers in any one year is simply the percentage distribution of births in that year by the age of their mothers.

inclusion of women at the point in time when the event occurs rather than randomly located in relation to it. But Brass (1969) noted that surprisingly these biases seem to have comparatively little effect, at least for high fertility populations. The mean numbers of live births appear to be similar to the corresponding values for mothers in the population.

Mathematically, and also by computer simulation, the examination of fertility models suggests that the reason for this fair agreement between mean number of births from vital registration and from the sample survey, is the dominance of the chance factors in birth probabilities over the variations among women. At late ages of maternity the bias due to the exclusion of sterile women certainly becomes substantial, but the proportion of current births in the group is small. This limited influence of bias shows that the mean numbers of children at the time of registration can be used satisfactorily as a comparative index of fertility for population sub-groups when such disturbing factors can plausibly be accepted as similar. The application of these suggestions to our data shows some very interesting results in the comparisons of average parity of mothers and women shown in Tables 2 and 3.

Table 2: Average Number of Children per Mother from Survey and Vital Registration

Age Group	Fertility Survey 1971				Vital Registration Data			
	I	II	III	IV	I	II	III	IV
15-19	1.068	1.308	1.171	0.971	1.189	1.275	1.216	1.200
20-24	1.980	2.008	1.802	1.718	2.082	2.482	2.219	2.029
25-29	3.134	3.351	3.185	3.234	4.065	3.974	3.819	3.931
30-34	4.980	4.687	4.745	4.159	4.074	5.711	5.427	5.611
35-39	5.674	6.282	5.779	5.747	7.067	7.196	6.473	6.714
40-44	6.195	7.361	7.145	6.297	7.839	7.765	7.366	7.278
45-49	-	-	9.000	8.000	8.263	8.307	7.687	7.222
Mean	3.974	4.325	3.909	3.815	4.481	4.263	4.049	4.182
P_1/P_2	0.539	0.651	0.650	0.565	0.571	0.514	0.548	0.591

Table 2 presents the average number of children per mother obtained from registration data on the number of children ever born by mothers reporting or registering a child (including the present child). It also presents the average number of children per mother from fertility sample survey data carried out in 1971 in all the project areas. The pattern of the average number of children born per mother by age and the overall ratio show some differences and similarities. The ratios are surprisingly similar for all the four areas at the younger age groups (15-24), but show some marked differences from ages 25 and up, due to over-representation of those women with above average fertility. Equally, the women reporting a birth in any one year are not a representative sample of all women (Table 1). In general, the average number of children per mother by age is higher for

records from vital registration than data from the fertility survey shown in Table 2.

In Table 3, an attempt was therefore made to estimate the average number of children ever born per woman in the project areas. The registration data had to be estimated indirectly, which Brass (1969) suggested could be done by excluding current births from the total number of children ever born according to the ages of the mothers. He maintained that this average is approximately similar in pattern to those obtained from sample fertility surveys from all women. The application of this to our data is also shown in Table 3.

Table 3: Average Number of Children per Woman by Area

Age Group	Fertility Survey 1971				Vital Registration 1st 12 Months.			
	I	II	III	IV	I	II	III	IV
15-19	0.263	0.270	0.350	0.195	0.189	0.274	0.216	0.200
20-24	1.661	1.277	1.546	1.467	1.083	1.482	1.220	1.229
25-29	3.108	3.111	3.100	3.212	3.065	2.974	2.819	2.931
30-34	4.885	4.568	4.745	4.434	5.074	4.711	4.428	4.611
35-39	5.611	6.000	5.779	5.682	6.067	6.196	5.473	5.714
40-44	5.963	7.260	6.944	6.213	6.838	6.765	6.366	6.278
45-49	-	-	-	-	7.263	7.308	6.688	6.222
Total	3.048	3.436	3.218	2.960	3.481	3.263	3.049	3.182
P_1/P_2*	0.158	0.211	0.226	0.133	0.175	0.185	0.177	0.194

*Note that on the whole the P_1/P_2 ratio (average number of children in the age group 15-19 to 20-24) shown in Table 2 fall outside the range of Brass's multipliers, whereas those shown in Table 3 are within the range.

Although the pattern of differences between the two sets of data may be complex, the main features are clear. The results of the comparison are quite close at the younger age groups but, again, at the older age groups show some differences which are more marked in Area I than in the other three areas. The variations which occur by area at earlier or later ages are probably due to differences in the proportions of women who are childless. This is because there is a close relationship between the average number of children per mother*, average number of children per woman and the proportions of childless women. To explore the explanation for any differences in the estimates, we calculated from the sample fertility survey data the proportions of women who became mothers according to age. This is shown in Table 4.

Table 4: Percentage of those who Become Mothers by Age Group by Area in The Fertility Survey

Age Group	AREA I	II	III	IV
15-19	24.6	20.6	29.9	20.1
20-24	83.9	86.9	85.8	85.4
25-29	99.2	95.9	97.3	99.3
30-34	98.1	97.5	100.0	98.1
35-39	98.9	95.5	100.0	98.8
40-44	96.3	98.6	97.2	98.7

*Average number of children per mother = $\frac{\text{Average No. of Children per Woman}}{\text{1.0 - Proportion of Women Childless}}$

There are some differences between areas in the proportions of women who became mothers at the 15-19 age group, however, these differences almost become negligible at the older ages when the proportion of childless women is known to be constant and small in most African populations (Brass, et al., 1968). It seems that the proportions of women who become mothers at the ages twenty-five and above are quite high. This could be attributed to the small sample size or possibly the inaccuracy of age reporting of women in the middle reproductive age groups. However, the agreement between the average number of children per woman obtained from sample survey, and those obtained from registration data using indirect techniques, is generally quite satisfactory, except perhaps for Area I.

ii) Age Specific Fertility Rates and Age Patterns, and Structure of Fertility Curves from Vital Registration Records

The data for the comparative analysis on the age patterns of fertility as well as the age structure of fertility are taken from the recorded age specific fertility rates from vital registration data shown in Table 5. These are presented in the form of relative age specific fertilities in Table 6. The recorded age specific fertility rates are also shown by sex. These are used for the estimation of the total fertility rate, the gross reproduction rate, the mean, the median, the mode and the variances of the age specific fertility curves. The age specific fertility rates are the number of children born in a specific time period (usually a year) per woman in a particular age group. The total fertility is the sum of the age specific fertility rates to all women in the reproductive years, most generally between the ages 15-49.

If these rates are assumed to represent average fertilities of women of the ages covered, then one can multiply each of these age specific rates by five and add them to obtain the value of total fertility.

The gross reproduction rate is the number of female children born per woman in a particular time period. It is perhaps one of the best demographic indicators of future fertility as it refers to the females, who will bear the children of future generations. The level of the total fertility rate, and hence of the gross reproduction rates, depends on the age structure of the women, the shape of the age specific fertility curves, and the range of the women under consideration. The examination of the age patterns and age structure of fertility shown in Tables 7-10 is done for vital registration data alone.

Table 5

Age Specific Birth Rates from Fertility

Survey and Vital Registration

by Sex and Area

Age Group	Fertility Survey 1971				VITAL REGISTRATION											
					Area I			Area II			Area III			Area IV		
	I	II	III	IV	M	F	Total	M	F	Total	M	F	Total	M	F	Total
15-19	0.1229	0.1030	0.1241	0.0689	0.0502	0.0437	0.0939	0.0559	0.0497	0.1056	0.0918	0.0617	0.1535	0.0488	0.0349	0.0837
20-24	0.3983	0.3723	0.2979	0.3285	0.1193	0.1432	0.2625	0.1628	0.1959	0.3587	0.1416	0.1646	0.3062	0.1255	0.1431	0.2686
25-29	0.3166	0.3469	0.2933	0.3767	0.1393	0.1486	0.2879	0.1730	0.1672	0.3402	0.16[illegible]	0.1753	0.3410	0.1888	0.1818	0.3706
30-34	0.3461	0.3051	0.4042	0.2736	0.1415	0.1608	0.3023	0.1479	0.1415	0.2894	0.1701	0.1632	0.3333	0.1873	0.1451	0.3324
35-39	0.3444	0.2697	0.3023	0.2614	0.1264	0.1524	0.2788	0.0912	0.0702	0.1614	0.1147	0.1029	0.2176	0.1288	0.1074	0.2362
40-44	0.1000	0.1781	0.1831	0.1472	0.0687	0.0496	0.1183	0.0652	0.0826	0.1478	0.0791	0.0683	0.1474	0.0480	0.0725	0.1305
45-49	-	-	-	-	0.0505	0.0367	0.0872	0.0138	0.0459	0.0597	0.0669	0.0520	0.1189	0.0241	0.0120	0.0361
Total	1.623	1.575	1.606	1.456	0.6959	0.7350	1.4309	0.7098	0.75[illegible]0	1.4628	0.8299	0.7880	1.6179	0.7613	0.6968	1.4581
Total x 5 T.F.R.	8.11	7.87	8.03	7.28	3.48	3.68	7.15	3.55	3.77	7.3[illegible]	4.15	3.94	8.09	3.80	3.48	7.29

Table 6: Relative Percentage Age Specific Fertility Distributions from Survey and Registration Data

Age Group	Fertility Survey 1971				Vital Registration 1st 12 Months			
	I	II	III	IV	I	II	III	IV
15-19	7.5	6.5	7.7	4.7	6.6	7.2	9.5	5.7
20-24	24.5	23.6	18.5	22.6	18.3	24.5	18.9	18.4
25-29	19.4	22.0	18.3	25.9	20.1	23.3	21.2	25.4
30-34	21.3	19.4	25.3	18.8	21.1	19.8	20.6	22.8
35-39	21.2	17.2	18.8	17.9	19.5	11.0	13.5	16.3
40-44	6.1	11.3	11.4	10.1	8.3	10.1	9.1	8.9
45-49	-	-	-	-	6.1	4.1	7.3	2.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
$\bar{m}$	29.1	30.2	20.1	29.6	31.4	30.0	30.8	30.6

It was noted by Gaisie (1971) that most of the fertility analysis carried out thus far in tropical Africa has been concerned with the estimation of fertility levels. Gaisie also found that little effort has been made to determine the age structure and patterns of fertility in order to enable a more comprehensive and incisive analysis of changes in fertility. The evaluation of family planning programmes requires more information about the structure and pattern of fertility. Therefore, the need for this type of analysis in Africa is greater today than ever before.

The determination of age patterns of fertility is beset by a number of problems the most important of which is the severe distortion of the age structures of African populations by age misreporting and time reference errors.

In spite of these difficulties, the age pattern of fertility can be reliably obtained from questions asked in census surveys about children born during a specified period. This expectation is based on the persuasive argument supported by experience that despite erroneous average judgement on the length of the reference period,there is no reason why such an error should be correlated with the age of the respondents in any systematic fashion.

The analysis of age patterns will include the estimation of the central measures of the fertility distribution such as the mean, the median, the mode, the variance and the standard deviations of the fertility curve, the degree of of skewness and the gradients of the curve at specified points. The classification of the age specific fertility schedules are according to U.N. and Pavlik's models. The aim of the analysis and classification methods employed in this section is to enable description and classification of the age specific fertility rates in the project areas. Another aim is to study the age structure with a view to examining some of the implications of such patterns and structures for population growth in the project areas.

a) Measures of Central Tendency and Dispersion for the Age Curves of Fertility in the Project Areas

The estimates of central tendency for the age specific fertility curves presented in Table 7 are derived from Table 6.

Table 7: Measures of Central Tendency and Dispersion for the Age Curves of Fertility by Area From Vital Registration Data

Area	$\bar{m}$	Median	Mode	Degree of Skewness	Variance	SD*	CV*
I	31.4	31.3	30.5	0.11	64.8	8.0	0.25
II	30.0	29.4	28.2	0.10	66.1	8.1	0.27
III	30.8	30.1	28.7	0.25	69.7	8.3	0.26
IV	30.6	30.1	29.1	0.20	52.6	7.3	0.24
U.N. Models							
Early Peak	28.0	26.6	23.8	0.54	59.7	7.7	0.27
Broad Peak	29.2	28.1	25.9	0.44	53.7	7.3	0.25
Late Peak	30.0	29.6	28.8	0.17	50.5	7.1	0.23

* SD - Standard Deviation CV - Coefficient of Variation

Table 7 shows that, in general, the pattern is such that the mode is first located, followed by the median and the mean in the direction of skewness which is to the right. The shapes of the fertility curves for all the areas are therefore characterised by slight positive skewness and hence are nearly symmetrical in shape. In Areas I and II the degree of skewness is as low as 0.10 and 0.11 whereas in Areas III and IV the magnitudes are 0.25 and 0.20 respectively. Compared to the U.N. Models shown in the same table, the curves have a resemblance, as far as skewness is concerned, to the late peak models of the U.N. type. The variances and hence, the standard deviation are larger than those shown by the U.N. models but the coefficients of variation of the curves are very close to those of the U.N. models. The magnitudes of the coefficient

of variation are such that they resemble the three types of U.N. curves.

The area under the curve of a graph of relative age specific fertility plotted against age represents the total fertility rate. However, this can be influenced by the degree of scatter around the mean value of the distribution, that is, the higher the variances, the greater is the area under the curve. The extent of variances is shown in Table 7. Area III reveals the highest variance or scatter around the mean and therefore is likely to have the larger total fertility rate. In fact, according to the observed total fertility rates for the project areas, Area III has the highest total fertility rate among the four areas.

b) Gradients of Fertility Curves at Specified Ages in the Project Areas

Fertility curves, like many other curves, may differ in their degree of steepness in both the first half of the reproductive period and also in the degree of decline at the end. The decline may be rapid or gradual depending upon many factors. To measure the steepness and decline of the curve, the mean value theorem was used to obtain $f^1(x)$ or the first derivative at the specified ages shown in the table by the use of the formula:

$$f^1(x) = \frac{f(x + h) - f(x - h)}{2h}*$$

This measure is useful in showing the extent to which the specific fertility curves vary from one to another, or in other words, the degree of change from age to age.

*The formula is approximate, particularly if the intervals are large.

Table 8: Shape of the Age Curve of Age Specific Fertility Schedules From Vital Registration Data

Area	$f^1(x)$ - Gradients at Different Ages				
	22	27	32	37	42
I	+1.35	+0.28	-0.06	-1.28	-1.34
II	+1.63	-0.47	-1.23	-0.97	-0.69
III	+1.17	+0.17	-0.76	-1.15	-0.63
IV	+1.97	+0.44	-0.91	-1.39	-1.38
U.N. Models					
Early Peak	+0.57	-0.73	-1.01	-1.16	-0.95
Broad Peak	+1.53	-0.38	-0.97	-1.34	-1.28
Late Peak	+1.90	+0.39	-0.74	-1.49	-1.58

The results are striking in that Areas I, III and IV show positive gradients at ages 22 and 27 and Area II shows a positive gradient at age 22 only. A comparison of the results to the U.N. Models shows the Late Peak has positive gradients at ages 22 and 27 and thus reveals that Areas I, III and IV follow the late peak U.N. model pattern whereas Area II follows essentially the Broad Peak U.N. Model. The magnitudes and the directions of the gradients at age 22 are of the same magnitude as shown by the Late Peak or Broad Peak U.N. Model at this age. At age 27, the sizes of the gradients basically follow this pattern of the Broad Peak and Late Peak Models. At 32, the size of the gradient recorded for Area I is rather small compared to the U.N. Models, but at ages 37 and 42 the magnitudes are about the same.

c) Pavlik and U.N. Models

Differences between various age curves of fertility can also be examined by comparing the relative shares (percentages) of the total fertility in the various age groups. Pavlik, in his study of empirical typology of the age curve of fertility, described five different types of fertility curves with different cumulative values. His classifications are shown in Table 9 according to the proportion of total fertility to ages under 30, under 35, under 20, and over 40 years. The classification models of the age specific fertility schedules according to Pavlik's and U.N. Models are shown in Tables 9 and 10.

Table 9: Percentages of Total Fertility in Specified Age Groups

Type	15-29	15-24	15-19	40-49
A	41-50	11-20	0-5	9+
B	51-60	21-30	6-10	7-8
C	61-70	31-40	11-15	5-6
D	71-80	41-50	16-20	3-4
E	81-90	51-60	21-25	0-2

Source Pavlik, Z. "Empirical Typology of the Age Curve of Fertility (Unpublished) See for example, page 37 of "Age Patterns of Fertility" by Nassef, A. and Gaafar, M.O. (1971), Fertility Trends and Differentials in Arab Countries, Cairo Demographic Centre.

Table 10: Age Patterns of Fertility Schedules by Area According to Pavlik's and U.N. Models from Vital Registration Data

Type Age And Area	15-29	15-24	15-19	40-49	Type	United Nations Classification
I	45.0	24.9	6.6	14.4	ABBA	LP
II	55.0	31.7	7.2	14.2	BCBA	BP
III	49.6	28.4	9.5	16.4	ABBA	LP
IV	49.5	24.1	5.7	11.4	ABAA	LP
U.N. Models						
Early Peak	62.8	40.9	16.2	8.1	CCDB	EP
Broad Peak	57.0	32.6	8.9	8.4	BCBB	BP
Late Peak	49.6	25.0	5.6	9.4	ABAA	LP

The results indicate that Areas I, III and IV display essentially the same shape of age curves as the AB... Type whereas Area II displays the BC... Type. This classification confirms our earlier results and findings that Areas I, III and IV belong to the U.N. Late Peak model and Area II shows the Broad Peak type. The variations of percentages in the first half of the reproductive period is most likely due to differences in ages of women at marriage, but it may also be due to differences in the proportions of women marrying in the different populations or to differences in the extent of birth control practices.

At the end of the curve, the percentages falling into the 40-49 age group are influenced by such factors as sterility, divorce, separation and re-marriage rates as well as the force of mortality operating within

those populations. The main conclusion drawn from the use of the models is that Areas I, III and IV have the same shape of age specific fertility schedules and Area II follows another shape.

iii) Age Specific Order Birth Rates in the Project Areas

The birth order of the child is another dimension to be considered in analysing fertility. Order of birth refers to the number of children born alive to the mother, including the present child. Information of the type described was also collected from mothers at the time of a notification of a birth and the results are presented in Table 11 for Area I*. Shown in Table 12 is the summary of contributions of Birth Order to the Total Fertility Rate by Area.

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*Data for other areas are shown in the Appendix.

Table 11

Age Specific Order Rates of Area I by Parity

Parity \ Age	15-19	20-24	25-29	30-34	35-39	40-44	45-49	Total	Total x 5	Percent
1st 12 months										
1st	0.0793	0.0694	0.0155	-	-	-	-	0.1642	0.8210	11.5
2nd	0.0129	0.1258	0.0433	-	-	-	-	0.1820	0.9100	12.7
3rd	-	0.0586	0.0712	0.0289	-	-	-	0.1587	0.7935	11.1
4th	-	0.0087	0.0960	0.0161	-	-	-	0.1208	0.6040	8.5
5th	-	-	0.0402	0.0740	0.0335	-	-	0.1477	0.7385	10.3
6th	-	-	0.0279	0.0740	0.0483	0.0115	-	0.1617	0.8085	11.3
7th +	-	-	-	0.1286	0.1896	0.0916	0.0826	0.4924	2.4620	34.6
Total	0.0922	0.2625	0.2941	0.3216	0.2714	0.1031	0.0826	1.4275	7.1375	-
Pc.	6.5	18.4	20.6	22.5	19.0	7.2	5.8	-	-	100.0
2nd 12 months										
1st	0.0544	0.0638	0.0109	-	-	-	-	0.1291	0.6455	10.0
2nd	0.0155	0.0653	0.0391	0.0058	-	-	-	0.1257	0.6285	9.7
3rd	-	0.0549	0.0717	0.0409	-	-	-	0.1675	0.8375	13.0
4th	-	0.0267	0.0696	0.0380	0.0134	-	-	0.1477	0.7385	11.4
5th	-	0.0059	0.0717	0.0614	0.0436	-	-	0.1826	0.9130	14.1
6th	-	-	0.0217	0.0702	0.0436	0.0070	-	0.1425	0.7125	11.0
7th +	-	-	0.0174	0.0877	0.1275	0.1150	0.0488	0.3964	1.9820	30.8
Total	0.0699	0.2166	0.3021	0.3040	0.2281	0.1220	0.0488	1.2915	6.4575	-
Pc	5.4	16.8	23.4	23.5	17.7	9.4	3.8	-	-	100.0

Table 12

Contribution of Birth Order to Total Fertility Rate

1st 12 months

Parity	AREA I	II	III	IV*
1st	11.5	11.9	15.5	13.8
2nd	12.7	14.9	12.1	14.0
3rd	11.1	14.7	12.7	10.0
4th	8.5	9.0	11.1	10.9
5th	10.3	12.0	11.4	13.2
6th	11.3	12.5	12.4	11.6
7th +	34.6	25.0	24.8	26.6
Pc	100.0	100.0	100.0	100.0
Total	1.43	1.46	1.61	1.46
T.F.R.	7.1	7.3	8.1	7.3

2nd 12 months

1st	10.0	13.3	11.8	-
2nd	9.7	15.0	13.9	-
3rd	13.0	13.3	11.9	-
4th	11.4	13.7	12.4	-
5th	14.1	9.2	10.7	-
6th	11.0	9.4	11.9	-
7th +	30.8	26.1	27.4	-
Pc	100.0	100.0	100.0	-
Total	1.29	1.38	1.83	-
T.F.R.	6.5	6.9	9.2	-

* No figures available for Area IV for the second 12 months.

The results from Table 11 indicate that first births are mainly from women between the ages 15-19. By the age 30, the contribution of first births to the total births is effectively zero. Similarly, second births are mainly to women from 15 to about 35, and the seventh-or-more births are to women age 30-50. In spite of the general limitations of the data in regard to age-misstatement, the results are surprisingly similar from area to area.

In Table 12, the contributions of age specific order of birth rates to total fertility are examined. Apart from minor variations, contributions of each order up to the sixth is over ten per cent, with second births taking a much higher share of the total contributions. The seventh and over births contribute something of the order 25-35 per cent, with Area I showing the highest percentage of some 34.6 per cent. The variations between the other three areas are not very substantial.

iv) Estimates of Fertility from Current Fertility and Retrospective Data from Vital Registration

Assuming that the population of the project area has not been subject to any major fluctuations in fertility or to marked changes in mortality, its fertility can be estimated by Brass's technique (1968). This method utilizes multipliers for correcting the reported age specific fertility rates, that is, the comparison of cumulated current rates with reported retrospective levels. These multipliers relate the following factors: the recorded parity for age group a; F(a) to the cumulated age specific fertility to the bottom of the age group; $\phi(a)$ plus k(a); the multiplier times the age specific fertility for age group a, f(a), i.e. $F(a) = \phi(a) + k(a)\ f(a)$.

The value of k(a), however, depends on the shape and position of the age specific fertility schedule. By employing the set of Brass's multipliers, it is possible to compare the reported current fertility with the reported parity and correct the level of the former accordingly. The appropriate model, and hence the appropriate correction factor, is selected by either the mean age of the fertility schedule or the steepness of the beginning of the fertility curve f_1/f_2. The correction factors reflect the curvature of an underlying set of model age specific fertility patterns. Although the method has been used extensively, it is very sensitive to massive and systematic age-misstatements which are common in Africa. (Brass, 1968) An application of the method to similar data collected from vital registration forms is shown in Table 13. Here the P_i/F_i ratios are shown by area for data from the fertility survey and vital registration.

The P_i/F_i ratios are also shown in Table 12, but their interpretation is very problematic. Ordinarily, it could be assumed that reports on children born to women between 20-24 tend to be reliable (Brass, 1968). By definition these reports are not affected by the problem of time reference error, and the "forgetting" of children at such an age is highly unlikely. Hence any discrepancies between the values of P_2/F_2 and the expected value of 1.00 reflects a period reference error in the current fertility rates.

Table 13: Adjustment Factors P_i/F_i from Survey and Vital Registration

Age Group	Fertility Survey 1971				Vital Registration 1st 12 Months			
	I	II	III	IV	I	II	III	IV
15-19	1.13	1.45	1.29	1.76	0.99	1.69	0.94	1.52
20-24	0.95	0.91	1.05	1.17	0.89	0.98	0.81	0.82
25-29	0.87	0.91	1.03	1.03	1.16	0.89	0.85	1.02
30-34	0.93	0.90	0.99	0.94	1.22	0.80	0.88	0.99
35-39	0.80	0.92	0.88	0.94	1.08	1.03	0.86	0.95
40-44	0.75	0.96	0.87	0.88	1.04	0.99	0.88	0.91
45-49	-	-	-	-	1.02	1.00	0.84	0.86
Recorded T.F.R.	8.1	7.9	8.0	7.3	7.2	7.3	8.1	7.3
Adjusted T.F.R.	7.7	7.2	8.4	8.5	-	-	-	-

There is a surprisingly low level of the P_i/F_i ratios for the whole range for Area III, with values of .81 and .94 as shown in Table 13. The ratios show little tendency to fall with age of women, but rather consistently rise slightly with age. This pattern could be due to differential survival of women, to a fall in fertility, or perhaps to extensive migration. All three effects might be in operation. The evidence from the P_i/F_i ratios for the younger women suggests that there is about two to twenty per cent over-reporting of births in the current year. The P_2/F_2 ratios from survey show over-reporting of current births in Areas I and II and under-reporting of current births in Areas III and IV by some 5 per cent and 17 per cent respectively. The pattern of the P_2/F_2 ratios from vital registration

suggests over-reporting of current births in all areas. Existence of such discrepancies was checked by other methods.

Table 14: Indices of Over-reporting or Under-reporting of Births in the Current Year

Area	Age Group	Proportion of Women Who Become Mothers: From Survey M	Proportion of Women Who Become Mothers: From Vital Registration P (1+)	Ratio $\frac{M}{P(1+)}$	Fertility Survey 1971 P_2/F_2	Vital Registration P_2/F_2
I	25-29	0.992	0.8210	1.21	-	-
	20-24	0.839	-	1.02	0.95	0.89
II	25-29	0.959	0.8715	1.10	-	-
	20-24	0.869	-	1.00	0.91	0.98
III	25-29	0.973	1.2490	0.75	-	-
	20-24	0.858	-	0.69	1.05	0.81
IV	25-29	0.993	1.0050	0.99	-	-
	20-24	0.854	-	0.85	1.17	0.82

The most illuminating comparisons shown in Table 14 are between cumulated first-birth rates and the proportion of women who are mothers. The reporting of first births in a 12 month period will be affected by time scale errors (reporting of an event occurring outside the observation period), which is reasonable to expect due to the importance of a first birth and the youth of most mothers. Omissions and age differentials in the reference period will have little influence. The classification of a

woman as a mother will be less subject to error than the determination of the number of children born to her. For these reasons, and because the proportion of women who become mothers after the age of 30 years is small in most African populations (Brass, et al., 1968), the ratio of ever-fertile women to cumulated first-birth rates at ages 30-34 should be a useful index of the time scale error.

The age-specific first birth rates were calculated and cumulated to give a measure analogous to the total fertility for all births. The resulting index would be a current estimate of P(1 +), the proportion of women who become mothers. The table shows the estimates of P(1 +) found for the areas. Since Areas III and IV give proportions of women becoming mothers of well over 1.00, the first births reported in the survey year (1971) are too high. An indication of the corrections needed for over-reporting can be obtained by dividing the proportions of women, "m" (in the age group 20-24 years recorded as being mothers) by the corresponding estimate of P(1 +). Omissions of births from reports should not bias these corrections.

The correction estimated from the M/(P(1+)) values in Areas III and IV are even greater than those found from the P_1/F_1 rates. It seems likely, however, that some of the discrepancies reflect a genuine differential between the reporting of first births and later births. The over-reporting of first births is presumably due to the enumeration or registration of children under one year who were brought in from outside the areas. These children should be properly registered as new migrants into the project areas. In Area III this phenomenon seems more prevalent than in the other three areas. This shows good reason why the C-D method (Chandrasekhar-Deming) fails to work

well, particularly for Area III. The method deals with problems of under-registration, and there seems to have been more over-reporting than under-reporting.

v) Summary Measures of Fertility or Indices of Fertility

Various measures of fertility estimated from the registration data are summarized in Table 15. These are the total fertility rates, the gross reproduction rates, the recorded birth rates from various sources, the child-woman ratio, the general fertility rate and the completed family size. The total fertility rates are derived from the age specific fertility rates shown in Table 15. The total fertility rate itself is simply the sum of the age specific fertility rates of all women in the reproductive years shown in five year intervals. If these rates are assumed to represent average fertility of women of the ages covered, these age specific rates can be multiplied by five and totaled to obtain the total fertility. The gross reproduction rate is the number of female children born per woman in a particular time period. It is perhaps one of the best demographic indicators of future fertility, as it refers to the females, who will bear the children of future generations.

The recorded total fertility rates from vital registration data for the first year of operation show that Area III has the highest level of fertility, followed by Areas II, IV and I in that order. This differs from the recorded total fertility rate obtained from an independent sample fertility survey carried out in 1971. The levels are about the same for Areas I, II and III and slightly lower for Area IV, but at the same level as that obtained from vital registration. The level of the total fertility

rates, and hence of the gross reproduction rates, depends on the age structure of the women, the shape of the the age specific fertility curves, and on the range of the women under consideration.

The completed family sizes, or measure of past reproductive performance, were estimated by an indirect method devised by Brass (personal communication 1973), as follows: Let ${}_5W_x$ be the number of women in population in 5 year age groups begining at x (x = 15, 20, etc.). ${}_5C^i{}_x$ is the number of births registered in the 12 month period of observation (by age group) to women who have already had i-1 births, (e.g. i-1 is for first births). ${}_5C_x$ is the total births, i.e. $\sum_i {}_5D^i{}_x$ to women in age group. Then ${}_5f^i{}_x = {}_5C^i{}_x/{}_5W_x$ is the age specific fertility for i^{th} births corresponding to the ${}_5f_x = {}_5C_x/{}_5W_x$ for all births. Calculate $F^i = 5 \sum_x {}_5f^i{}_x$ (over age groups) and $F = 5 \sum_x {}_5f_x$.

Then F^i is the proportion of women who will become mothers at age specific fertility of first births. If it is lower than seems reasonable in comparison with estimated proportions of women who become mothers based on retrospective recording or general knowledge, then under-reporting can be deduced, and if higher than 1.0, over-reporting can be deduced. $F_m = F/F^i$ gives the mean completed family age of mothers. Even if there is under-reporting, F_m will be accurate if it is the same for all birth orders. In general F_m should be more accurate than F or F^i separately. In order to calculate F_m, the absolute number of women in each age group is not needed. Since any factor K will cancel out in F/F^i, only the relative number is needed. Therefore the calculations can be made with model age distributions if the population at risk is not known. The application of Brass's method to the registration data is shown in Table 15.

Table 15

Summary Measures or Indices of Fertility

by Area from Survey and Registration

Measure	I	II	III	IV
1. Crude Birth Rate per 1000				
a) $C(x), 1_2$	38.7	44.0	52.5	41.3
b) Survey and Registration (Recorded)	40.2	44.9	55.1	46.4
c) Fertility Survey 1971	42.5	49.3	57.0	53.0
2. Total Fertility Rate				
a) Survey (Recorded)	8.1	7.9	8.0	7.3
b) Survey (Adjusted)	7.7	7.2	8.4	8.5
c) Registration (Recorded)	7.2	7.3	8.1	7.3
3. Completed Family Size	8.7	8.4	6.4	7.3
4. Gross Reproduction Rate				
a) Survey i) Recorded	4.0	3.9	4.0	3.5
ii) Adjusted	3.8	3.5	4.1	4.2
b) Registration	3.7	3.8	3.9	3.5
5. Child Woman Ratio per 1000	865	877	923	852
6. General Fertility Rate per 1000	196.0	215.9	250.2	209.4
7. Mean Age at Childbearing				
a) Survey	29.1	30.2	30.1	29.6
b) Registration	31.4	30.0	30.8	30.6
8. Percentage of the Relative Age Specific Fertilities in the 15-29 Age Group				
a) Survey	58.8	56.7	56.3	64.0
b) Registration	45.0	55.0	49.6	49.5
9. Variances of the Age Specific Fertility Curves				
a) Survey	55.8	54.1	59.8	49.0
b) Registration	64.8	66.1	69.7	52.6
10. Degree of Skewness				
a) Survey	-0.20	+0.00	-0.31	+0.08
b) Registration	0.11	0.10	0.25	0.20

Table 16: Summary of Relative Measures of Indices of Fertility by Area

Type and Source	I	II	III	IV
1. Birth Rate				
a) *C(x), 1_2	100	114	136	107
b) From Registration and Survey (Recorded only)	100	111	137	113
c) From Fertility Survey 1971	100	117	134	125
2. Total Fertility Rate				
a) Registration and Survey (Recorded)	100	101	113	101
b) Fertility Survey (1971)	100	96	99	90
3. Completed Family Size	100	97	75	83
4. Child-Woman Ratio	100	101	107	98
5. General Fertility Rate	100	110	128	107

*C(x) is the cumulative age distribution to age x

A comparison of the levels of total fertility with the estimated completed family sizes shows that in both Areas I and II, fertility may have been declining in recent years. In Area III, fertility may have been increasing since we have lower completed family size (a measure of past reproductive performance). And in Area IV, fertility appears to have been constant over the years.

The estimates of general fertility rate shown in Table 15 draw similar conclusions: Area III has the highest level of fertility followed by Area II, then Area IV and Area I. The crude birth rates estimated from the age structure as well as from the fertility survey and the recorded birth rates

from registration data also point to the same conclusions.

Estimates of child-woman ratio were made from the baseline registration survey carried out in 1971 in all areas. This ratio is strongly influenced by deficiencies such as under-enumeration to varying extents, by variations in infant and child mortality, and probably most importantly, by the effect of migration on population structure. In spite of these known deficiencies, it is an easily available measure for comparative analysis for areas or regions within the same country.

The child-woman ratio, estimated as children under five years to women in the age group 15-49, is as follows: Area I - 865, Area II - 877, Area III - 923, Area IV - 852 per 1000 women. The ratios show that Area III has the highest child-woman ratio followed by Area II, Area I and Area IV in that order. These conclusions should be seen in view of deficiencies in the recorded data itself and limitations of the method (Stable population theory or method). For example, in using the child-woman ratio as a fertility index, it is necessary to assume that under-enumeration and mortality are constants in the analysis. An additional difficulty is that the child-woman ratio has no inherent theoretical meaning; it is an index but not a rate of fertility. There is, however, a high correlation between child-woman ratio and the basic measures of fertility both in theory and in the project data. But it must be pointed out that these correlations are not nearly so high as the interrelationships among the basic fertility rate and the total fertility rate.

The mean ages of the specific fertility schedules by area have also been estimated and this varies between 29.1-31.4 as shown in Table 15. Theoretical works of Lotka (1939) on the stable population relationships

have shown that the higher the intensity of fertility (the mean number of children per woman) the higher will be the rate of increase; also, the lower the mean age at motherhood, the higher will be the rate of increase. From these theoretical considerations one can show the importance of the mean age of childbearing on population growth. For example, it can be shown that the same rate of growth can be achieved with a high age of child bearing and a high average number of children per mother as with a low average number of children and a low age of childbearing. Thus, a country with a high age of childbearing does not need to decrease its fertility as much as a country with a low age of motherhood in order to achieve a reasonable rate of population growth.

The stable population model analysis has also shown that in the long run, the rate of population growth, the crude birth rate, and the proportions of young persons in the population can be decreased either by decreasing the degree of fertility, or by increasing the mean age of childbearing (Lotka, 1939). The implication of these findings for our project areas is that population growth does not depend solely on the degree of fertility; the mean age of childbearing and the dispersion around the mean must be taken into account. This conclusion is important when setting up a fertility control policy in a developing country. The policy must not only aim at reducing the average number of children per mother, it must also try to increase the mean age of motherhood, not only for its beneficial impact in the long run, but also for its short-term effects. Furthermore, the population policy should not neglect the dispersion of births, and should appeal to younger women at least as much as to older women.

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Appendix Table 1

Number of Children Born per Mother by Area

2nd Twelve Months and Combined Vital Registration

Age Group	I	II	III	IV*	I	II	III	IV*
15-19	1.266	1.268	1.277	-	1.299	1.270	1.248	-
20-24	2.589	2.333	2.347	-	2.368	2.403	2.291	-
25-29	3.773	3.743	3.761	-	3.896	3.858	3.785	-
30-34	5.701	5.589	5.556	-	5.886	5.648	5.501	-
35-39	6.695	7.082	6.415	-	6.889	7.137	6.436	-
40-44	8.278	7.854	7.426	-	8.075	7.813	7.402	-
45-40	7.733	7.428	8.111	-	8.029	7.852	7.912	-
Total	4.248	4.035	4.233	-	4.356	4.143	4.155	-
P_1/P_2	0.489	0.544	0.544	-	0.519	0.529	0.544	-

Appendix Table 2

Number of Children Born per Woman by Area

2nd Twelve Months

Age Group	Area I	II	III	IV*
15-19	0.266	0.306	0.274	-
20-24	1.577	1.333	1.347	-
25-29	2.773	2.744	2.761	-
30-34	4.707	4.589	4.557	-
35-39	5.696	6.245	5.415	-
40-44	7.278	6.854	6.426	-
45-49	6.733	6.428	8.258	-
Total	3.249	3.035	3.234	-
P_1/P_2	0.1686	0.2010	0.2034	-

* No figures available for Area IV for the second 12 months.

Appendix Table 3

Age Specific Fertility Rates by Sex and Area (2nd Twelve Months)

Area	I			II			III			IV *		
Age Group	M	F	TOTAL	M	F	TOTAL	M	F	TOTAL	M	F	TOTAL
15-19	0.0356	0.0356	0.0712	0.0528	0.0558	0.1086	0.0598	0.0653	0.1251	-	-	-
20-24	0.1261	0.1053	0.2314	0.1626	0.1646	0.3272	0.1635	0.1577	0.3212	-	-	-
25-29	0.1152	0.1630	0.2782	0.1362	0.1645	0.3007	0.2084	0.2312	0.4396	-	-	-
30-34	0.1579	0.1316	0.2895	0.1358	0.1387	0.2745	0.1488	0.2128	0.3616	-	-	-
35-39	0.1376	0.0940	0.2316	0.0742	0.0839	0.1581	0.1384	0.1518	0.2902	-	-	-
40-44	0.0697	0.0557	0.1254	0.0704	0.0815	0.1519	0.0868	0.0840	0.1708	-	-	-
45-59	0.0325	0.0285	0.0610	0.0265	0.0354	0.0619	0.0540	0.0755	0.1295	-	-	-
Total	0.6746	0.6137	0.12883	0.6585	0.7244	1.3829	0.8597	0.9783	1.8380	-	-	-
Total x 5 (T.F.R.)	3.3730	3.0685	6.4415	3.2925	3.6220	6.9145	4.2985	4.8915	9.1900	-	-	-

* No figures available for Area IV for the second 12 months.

Appendix Table 4

Age Specific Birth Rates by Sex and Area (Combined)

Area	I			II			III			IV		
Age Group	M	F	TOTAL	M	F	TOTAL	M	F	TOTAL	M	F	TOTAL
15-19	0.0429	0.0397	0.0826	0.0544	0.0528	0.1072	0.0758	0.0635	0.1393	0.0488	0.0349	0.0837
20-24	0.1227	0.1243	0.2470	0.1627	0.1803	0.3430	0.1526	0.1612	0.3138	0.1255	0.1431	0.2686
25-29	0.1273	0.1558	0.2831	0.1546	0.1659	0.3205	0.1871	0.2033	0.3904	0.1888	0.1818	0.3706
30-34	0.1497	0.1462	0.2959	0.1419	0.1401	0.2820	0.1595	0.1880	0.3475	0.1873	0.1451	0.3324
35-39	0.1320	0.1232	0.2552	0.0827	0.0771	0.1598	0.1266	0.1274	0.2540	0.1288	0.1074	0.2362
40-44	0.0692	0.0527	0.1219	0.0678	0.0821	0.1499	0.0830	0.0762	0.1592	0.0580	0.0725	0.1305
45-49	0.0415	0.0395	0.0810	0.0202	0.0407	0.0609	0.0605	0.0638	0.1243	0.0241	0.1200	0.0361
Total	0.6853	0.6814	1.3667	0.6843	0.7390	1.4233	0.8441	0.8832	1.7285	0.7613	0.6900	1.4581
Total x 5 (T.F.R.)	3.4265	3.3720	6.7985	3.4210	3.6935	7.1145	4.2240	4.4160	8.6400	3.8065	3.4840	7.2905

Appendix Table 5

Relative Percentage Age Specific Distributions by Area for the 2 years Combined

Age	Area	II	III	IV*
15-19	6.0	7.5	8.0	-
20-24	18.1	24.1	18.2	-
25-29	20.7	22.5	22.6	-
30-34	21.7	19.8	20.1	-
35-39	18.7	11.2	14.7	-
40-44	8.9	10.6	9.2	-
45-49	5.9	4.3	7.2	-
Total	100.0	100.0	100.0	-
$\bar{m}$	31.5	30.1	31.1	-

* No figures available for Area IV for the second 12 months.

Appendix Table 6

Estimates of Recorded General Fertility Rate per 1,000 Women

Area	I		II		III		IV
Type	1st 12 Months	2nd 12 Months	1st 12 Months	2nd 12 Months	1st 12 Months	2nd 12 Months	1st 12 Months
Compre-hensive	184.6	167.0	204.8	191.9	236.7	253.1	208.0
De-Jure	196.0	180.1	215.9	201.3	250.2	264.8	209.4
De-Facto	155.4	120.1	148.0	145.3	217.4	229.0	176.7

Appendix Table 7

Age Specific Order of Area II by Parity

1st 12 Months

Age Group / Parity	15-19	20-24	25-29	30-34	35-39	40-44	45-49	Total	Total x 5	P.C.
1st	0.0007	0.0739	0.0147	-	-	-	-	0.1743	0.8715	11.9
2nd	0.0207	0.1176	0.0704	0.0096	-	-	-	0.2177	1.0885	14.9
3rd	0.0041	0.1170	0.0674	0.0257	-	-	-	0.2142	1.0710	14.7
4th	-	0.0280	0.0674	0.0354	-	-	-	0.1308	0.6540	9.0
5th	-	0.0153	0.0645	0.0643	0.0140	0.0174	-	0.1755	0.8775	12.0
6th	-	-	0.0381	0.0772	0.0291	0.0174	-	0.1618	0.9090	12.5
7th	-	-	0.0235	0.0804	0.0262	0.1174	0.0459	0.3934	1.0270	26.0
Total	0.1055	0.3662	0.3460	0.2926	0.1713	0.1522	0.0459	1.4397	7.2985	-
Pc	7.2	24.4	23.7	20.1	11.1	10.4	3.1	-	-	100.0

2nd 12 Months

1st	0.0014	0.0740	0.0283	-	-	-	-	0.1837	0.9185	13.3
2nd	0.0241	0.1232	0.0386	0.0202	-	-	-	0.2064	1.0320	15.0
3rd	-	0.0926	0.0668	0.01736	0.0065	-	-	0.1632	0.9160	13.3
4th	-	0.0309	0.0925	0.0462	0.0194	-	-	0.1890	0.9450	13.7
5th	-	0.0062	0.0463	0.0549	0.0194	-	-	0.1268	0.6340	9.2
6th	-	-	0.0231	0.0695	0.0290	0.0074	-	0.1289	0.6445	9.4
7th +	-	-	0.0129	0.0723	0.0968	0.1296	0.0487	0.3603	1.8015	26.1
Total	0.1055	0.3272	0.3085	0.2803	0.1711	0.1370	0.0487	1.3763	6.8915	-
Pc	7.7	23.7	22.4	20.3	12.4	9.9	3.6	-	-	100.0

Appendix Table 8

Age Specific Order Rates of Area III by Parity

1st 12 months

Age Group / Parity	15-19	20-24	25-29	30-34	35-39	40-44	45-49	Total	Total x 5	P.C.
1st	0.1218	0.0991	0.0289	-	-	-	-	0.2498	1.2490	15.5
2nd	0.0301	0.0956	0.0520	0.0092	0.0088	-	-	0.1957	0.9785	12.1
3rd	-	0.0779	0.0886	0.0276	0.0118	-	-	0.2059	1.0295	12.7
4th	-	0.0248	0.0636	0.0552	0.0294	0.0072	-	0.1802	0.9010	11.1
5th	-	0.0053	0.0482	0.0874	0.0324	0.0108	-	0.1841	0.9205	11.4
6th	-	-	0.0462	0.0759	0.0382	0.0252	0.0149	0.2004	1.0020	12.4
7th +	-	-	0.0212	0.0759	0.1059	0.1079	0.0892	0.4001	2.0005	24.8
Total	0.1519	0.3027	0.3487	0.3312	0.2265	0.1511	0.1041	1.8162	8.810	-
Pc.	9.4	18.7	21.6	20.5	14.0	9.4	6.4	-	-	100.0

2nd 12 months

1st	0.0975	0.0810	0.0315	0.0056	-	-	-	0.2156	1.0780	11.8
2nd	0.0255	0.1201	0.0875	0.0169	0.0045	-	-	0.2546	1.2730	13.9
3rd	0.0022	0.0753	0.0963	0.0320	0.0134	-	-	0.2192	1.0950	11.9
4th	-	0.0347	0.0998	0.0490	0.0268	0.0168	-	0.2271	1.1355	12.4
5th	-	0.0058	0.0525	0.0734	0.0558	0.0034	-	0.1959	0.9795	10.7
6th	-	-	0.0403	0.0923	0.0491	0.0252	0.0108	0.2177	1.0885	11.9
7th +	-	-	0.0385	0.0979	0.1362	0.1232	0.1079	0.5037	2.5185	27.4
Total	0.1252	0.3169	0.4465	0.3671	0.2858	0.1736	0.1187	1.8338	9.1690	-
Pc.	6.8	17.3	24.3	20.0	15.6	9.5	6.5	-	-	100.0

Appendix Table 9

Age Specific Order Rates of Area IV

by Parity

1st 12 months

Age Group / Parity	15-19	20-24	25-29	30-34	35-39	40-44	45-49	Total	Total x 5	P.C.
1st	0.0712	0.1059	0.0186	0.0093	-	-	-	0.2010	1.0050	13.8
2nd	0.0126	0.0863	0.0783	0.0237	0.0092	-	-	0.2041	1.0205	14.0
3rd	-	0.0529	0.0676	0.0237	-	-	-	0.1442	0.7210	10.0
4th	-	0.0137	0.0886	0.0237	0.0215	0.0109	-	0.1584	0.7920	10.9
5th	-	0.0078	0.0629	0.0544	0.0153	0.0217	-	0.1621	0.9605	13.2
6th	-	-	0.0303	0.0712	0.0491	0.0181	-	0.1687	0.8435	11.5
7th +	-	-	0.0326	0.1029	0.1300	0.0870	0.0281	0.3806	1.9430	26.6
Total	0.0838	0.2666	0.3729	0.3349	0.2331	0.1377	0.0281	1.4571	7.2865	-
Pc	5.8	18.3	25.6	23.0	16.0	9.4	1.9	-	-	100.0

Appendix Table 10

Relative Percentage Age Specific Distributions
by Area from Registration Data

Area / Age Group	I		II		III		IV
	1	2	1	2	1	2	1
15-19	6.6	5.5	7.2	7.8	9.5	6.8	5.7
20-24	18.3	18.0	24.5	23.7	18.9	17.5	18.4
25-29	20.1	21.6	23.3	21.7	21.2	23.9	25.4
30-34	21.1	22.5	19.8	19.8	20.6	19.7	22.8
35-39	19.5	18.0	11.0	11.3	13.4	15.8	16.2
40-44	8.3	9.7	10.1	11.0	9.1	9.3	8.9
45-49	6.1	4.7	4.1	4.7	7.3	7.0	2.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
$\bar{m}$	31.4	31.4	30.0	30.2	30.8	31.3	30.6

Appendix Table 11

Age Specific Fertility Rates and the Relative
Percentage Age Specific Fertility
Fertility Survey 1971 (12 months Prior to Survey

Age Group	Age Specific Fertility Rates				Relative Percentage Age Specific Fertility			
	I	II	III	IV	I	II	III	IV
15-19	0.1454	0.0793	0.1022	0.0747	8.8	5.4	6.3	5.3
20-24	0.3983	0.3036	0.2908	0.3065	24.1	21.1	18.2	21.9
25-29	0.3167	0.3470	0.2933	0.3698	19.3	23.8	18.3	26.4
30-34	0.3750	0.3305	0.4043	0.2547	22.7	22.6	25.2	18.2
35-39	0.3020	0.2697	0.2907	0.2727	28.3	18.6	18.0	19.6
40-44	0.1125	0.1333	0.2254	0.1204	6.8	9.5	14.0	8.6
Total	1.6478	1.4564	1.6067	1.3988				
Total x 5 = G.F.R.	8.2	7.3	8.0	7.0	100.0	100.0	100.0	100.0

Appendix Table 12

Measures of Central Tendency for the Age Specific Fertility Distribution from Survey Data (1971)

Area	Mean	Median	Mode	Degree of Skewness	Variance	S.D.	C.V.
I	29.1	29.6	30.6	-0.20	55.0	7.5	0.26
II	29.5	29.5	29.5	+0.00	54.1	7.4	0.25
III	30.1	30.9	32.5	-0.31	59.8	7.7	0.26
IV	29.6	29.4	29.0	+0.08	49.0	7.0	0.23

Appendix Table 13

Measures of Central Tendency for Age Specific Fertility Distribution from Survey Data (12 months prior to Survey Date)

Area	Mean	Median	Mode	Degree of Skewness	Variance	S.D.	C.V.
I	28.9	29.4	30.3	-0.20	50.5	7.1	0.24
II	29.7	29.9	30.5	-0.12	46.9	6.9	0.23
III	30.6	31.5	33.1	-0.35	53.7	7.2	0.24
IV	29.5	29.2	28.4	+0.15	53.7	7.2	0.24