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AN ANALYSIS OF THE POPULATION SIZE, AGE/SEX DISTRIBUTION

Monograph Series, Number 6

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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The Basic Demographic Characteristics of the Danfa Project Areas-

An Analysis of the Population Size, Age/Sex Distribution

1. Introduction

The Danfa Comprehensive Rural Health and Family Planning Project is a joint effort of the University of Ghana Medical School and the University of California, Los Angeles (UCLA) School of Public Health in cooperation with the Ministry of Health, Ghana and with the financial support of the U.S. Agency for International Development (USAID). Background information concerning the history, objectives, research design and the philosophy of approach to the organisation and the implementation of the project has been presented in previous papers (Neumann, et al 1972, Sai, et al, 1972, Neumann, et al 1973, Neumann, et al, 1974). The rural communities involved--approximately 300 villages and hamlets with 55,000 people--are located within about 50 miles of Accra. The project administers service, teaching and research components.

The research area is divided into four subareas, each of which is provided a different set of service inputs. The objective is to determine the effects of these inputs on improving villagers' (especially children's) health with the ultimate goal of measuring the effect such health improvement will have on the villagers' outlook toward family planning acceptance. As in other similar projects with an important research component, it was necessary to determine the basic demographic characteristics of the population under study.

In a series of papers, of which this is the first, our main concern will be to present and to discuss the main demographic characteristics which were investigated during the project's baseline enumeration initiated in September 1970. This paper, specifically, will deal with the analysis of population size and the age/sex distribution of the four project areas.

The initial planning for the data collection for this project included discussions with a number of participating agents, compilation of maps of villages and hamlets, selection and training of field staff, and the organisation of the field work. Methods of procedure were perfected and refined and record forms revised as the project survey proceeded. In general, however, fieldwork followed original survey and sampling design plans discussed in the Research Design. (Neumann, et al, 1974).

The main purpose of the baseline registration was to form a benchmark for the project's longitudinal studies and provide us with a profile of the essential demographic features of the project areas. This is a fundamental requirement for many research efforts because without such a profile, information on which to plan community services may be inadequate or misleading. For the Danfa Project, it was deemed essential because the achievement of many of the goals and objectives of the project could only be assessed if the statistics were known for quite small areas in which every person is enumerated. In addition, the baseline registration

with its successive updating has other potential advantages for the project, e.g., it provides a sampling frame for other surveys which may be undertaken during the life of the project.

Information was sought from individuals on age, sex, marital status, household composition and relationship, ethnic composition, religion, occupation, literacy and level of education. The methods used in the measurement of these variables as well as conceptual and analytical difficulties experienced in measuring the variables will be discussed in the relevant sections of this paper.

2. Presentation and Analysis of the Basic Demographic Characteristics

The alternatives for data presentation and analysis are numerous. For example, the size and the composition of the population can be presented for the different types of population enumeration--de jure, de facto and comprehensive.* We have attempted to present and analyse the population size and age/sex distributions by all three methods of enumeration.

*De Jure Population consists of permanent residents present and permanent residents who are temporarily away.

De Facto Population consists of permanent residents present and temporary residents (long-term visitors) and short-term visitors. (For all practical purposes temporary residents (long-term visitors) and short-term visitors come under the general heading of 'visitors'.)

Comprehensive Population consists of permanent residents, permanent residents temporarily away and visitors (long-term or temporary residents and short-term visitors).

The main statistical techniques used in the analysis were the computation of proportions and percentages for all cells for comparative purposes. In most cases, these percentages do not add up to 100.0 because of rounding of errors. All the "unknowns"* are distributed so that the distribution for the given six with unknown ages or other variables remains unchanged.

3. The Size of the Population (Tables 1A-1D, 2A-2C, 3A-3C) The size of a population is usually the first demographic fact that one attempts to obtain in a census survey enumeration, but the concept is not so simple as may appear at first sight. There are two ideal types of total population counts: the de facto and the de jure counts. In practice, modern censuses or enumerations call for one of these ideal types with specified modifications, but it is difficult to avoid some mixture of the two approaches, resulting in "comprehensive" coverage.

In the baseline enumeration of the Danfa Project, the comprehensive type of enumeration was adopted and the de jure and the de facto population figures separated at the tabulation stage. Comprehensive enumeration allowed us to initiate a vital events registration system for the project which could use either the de jure of de facto concepts in registering events.

*This is performed by multiplying the population classified by age by the ratio-

$$\frac{\text{Total Population}}{\text{(Total Population - Population With Ages Unknown)}}$$

Furthermore, the complications which could result using only the de jure or the de facto methods were recognized.

Comprehensive type enumeration had a number of implications for training enumerators, above all, they had to learn how to register both the de jure and the de facto populations. This meant more complicated training, instructions and more training time, and an increased chance for defective work and inaccurate results. The enumerators were taught to identify those who are usual residents and were present at the time of the enumerations, those who are usual residents but were temporarily away, and those classified as visitors.

There were also a number of difficulties in applying these techniques in the field. For example, in the application of the de jure concept, there has always been the difficulty of obtaining accurate information about persons who are absent; equally, the de facto approach involves obtaining information about visitors, many of whom are absent at the time of the interview and who may have little connection with the household in which they are staying. In any case, the choice of either the de facto or the de jure method allows the enumerator what could be a research-endangering loop hole: any unwanted or doubtful case can be excluded on the grounds that the respondent belongs to the category not to be enumerated--one other reason why the comprehensive method was favored.

In Tables 1A to 1C, the distribution of the total population is shown by the de jure, de facto and comprehensive type population enumerations.

Table 1A

The Size of the Population by De-Jure, De-Facto and Comprehensive Type Enumerations

De-Jure Population

Sex	Areas I	II	III	IV	TOTAL
M	5,819	5,127	6,474	6,509	23,929
F	5,497	5,038	6,642	6,549	23,726
Total	11,316	10,165	13,116	13,058	47,655
General Sex Ratio	105.8	101.7	97.5	99.4	100.8

Table 1B

De-Facto Population

Sex	Areas I	II	III	IV	TOTAL
M	5,832	5,200	6,639	6,517	24,188
F	5,533	5,139	6,901	6,641	24,214
Total	11,365	13,540	13,540	13,158	48,402
General Sex Ratio	105.4	101.2	96.2	98.1	99.9

Table 1C

Comprehensive Population

Sex	I	II	III	IV	TOTAL
M	6,114	5,375	6,755	6,762	25,006
F	5,845	5,306	7,058	6,912	25,121
Total	11,959	10,681	13,813	13,674	50,127
General Sex Ratio	104.6	101.3	95.7	97.8	99.5

Table 1D shows the ratio of the Resident Population to the Population Present in the four geographical areas by sex. For all the areas enumerated, the de jure type population is less than the de facto type population. The ratios do not indicate any significant sex differentials for any of the areas. It may be noted here that if the comprehensive methods were used for a nationwide enumeration, the number of absent residents would be approximately equal to the number of visitors. It is not clear what interpretation one could put on the discrepancy in this enumeration, although we believe it to be insubstantial. The possibility of differential under-enumeration of some elements in the population is suggested by the discrepancy between the de jure and de facto estimates. There is an inherent difficulty of complete enumeration of persons temporarily absent and of persons recently settled in new localities. Differences may exist by sex and age which may cause apparent deviations but it is difficult to evaluate or measure the possible effects.

It is clear from Table 2B that the short-term visitors in the project areas form a very small percentage of the total comprehensive population enumerated. For all practical purposes, the following analyses now refer to temporary visitors and temporary residents (long-term visitors) as visitors. The analyses and the conclusions drawn remain unchanged by this modification.

Table 2C shows the percentage distribution of the comprehensive population by geographical areas and residential status. The percentage distribution of the de facto and the de jure populations can also be extracted from Table 2C. It is obvious that the two estimates have a

Table 1D

Ratio of Resident Population to Population Present in the Four Geographical Areas by Sex

Area	Sex	Ratio M	F	M + F
I		0.997	0.993	0.995
II		0.986	0.980	0.983
III		0.975	0.962	0.968
IV		0.998	0.986	0.992
Total		0.989	0.972	0.984

Table 2A

Distribution of the Comprehensive Population by Numbers According to Residential Status*

Area	Sex	Permanent	Temporary Absent	Temporary Resident	Visitor	Total
I	M	5,537	282	251	44	6,114
	F	5,185	312	264	84	5,845
II	M	4,950	175	208	42	5,375
	F	4,868	168	212	58	5,306
III	M	6,340	118	250	47	6,762
	F	6,185	157	357	59	7,058
IV	M	6,266	245	209	42	6,762
	F	6,280	270	313	49	6,912

* 1. Permanent A person who has been in the household continuously for six months or more and intends to continue for six months or more.

2. Temporary Absent A usual member of the household but absent at the time of interview and spends more than six months of the year in household.

3. Temporary Resident Not a member of the household but has been in household for more than a week but less than six months and does not intend to stay for six months (long-term visitor).

4. Visitor Not a member of the household, but has been visiting for less than a week and does not plan to stay for more than a week (short-term visitor).

Table 2B

Percentage Distribution of the Population According to Residential Status

Area	Sex	Permanent	Temporary Absent	Temporary Resident	Visitor	Total
I	M	90.5	4.6	4.2	0.7	100.0
	F	88.7	5.3	4.5	1.5	100.0
II	M	92.1	3.3	3.9	0.7	100.0
	F	91.8	3.1	4.0	1.1	100.0
III	M	94.1	1.7	3.7	0.5	100.0
	F	91.9	2.2	5.1	0.8	100.0
IV	M	92.7	3.6	3.1	0.6	100.0
	F	90.8	3.9	4.6	0.7	100.0

Table 2C

Percentage Distribution of the Comprehensive Population by Areas According to Residential Status

Sex	Males				Females			
Area	P	TA	V	Total	P	TA	V	Total
I	90.6	4.6	4.8	100.0 (6,114)	88.7	5.3	6.0	100.0 (5,845)
II	92.1	3.3	4.6	100.0 (5,375)	91.8	3.1	5.0	99.9 (5,306)
III	94.1	1.7	4.2	100.0 (6,755)	91.9	2.2	5.9	100.0 (7,058)
IV	92.7	3.6	3.7	100.0 (6,762)	90.8	4.0	5.2	100.0 (6,912)

Table 3A

Percentages of Present Residents (P); Temporary Away (TA); and Visitors (V) According to Age. AREA I

Age	Males					Females					TA - V	
	P	TA	V	Pc.	Nr.	P	TA	V	Pc.	Nr.	Males	Females
0-14	90.6	4.5	4.9	100.0	2,970	91.1	4.5	4.5	100.1	2,740	-0.4	0.0
15-44	88.7	5.5	5.8	100.0	1,981	84.9	6.3	8.8	100.0	2,071	-0.3	-2.5
45-64	93.8	2.5	3.7	100.0	760	88.7	6.6	4.7	100.0	746	-1.2	+1.9
65 +	93.3	5.2	1.5	100.0	403	93.4	3.5	3.1	100.0	288	+3.7	+0.4
Total (All Ages)	90.6	4.6	4.8	100.0	6,114	86.7	5.3	6.9	100.1	5,845	-0.2	-0.7

Table 3B

Percentages of Present Residents (P); Temporary Away (TA); and Visitors (V) According to Age. AREA II

Age	Males					Females					TA - V	
	P	TA	V	Pc.	Nr	P	TA	V	Pc.	Nr.	Males	Females
0-14	93.7	2.7	3.6	100.0	2,460	93.8	2.2	3.9	99.9	2,335	-0.9	-1.7
15-44	88.8	4.2	6.9	99.9	1,890	89.2	3.9	6.9	100.0	2,200	-2.7	-3.0
45-64	93.5	3.0	3.5	100.0	709	92.0	4.0	4.0	100.0	495	-0.5	0.0
65 +	96.5	2.5	0.9	99.9	316	92.8	3.6	3.6	100.0	276	+1.6	0.0
Total (All Ages)	92.1	3.3	4.6	100.0	5,375	91.8	3.1	5.0	99.9	5,306	-1.3	-1.9

Table 3C

Percentages of Present Residents (P); Temporary Away (TA); and Visitors (V) According to Age. AREA III

Age	Males					Females					TA - V	
	P	TA	V	Pc.	Nr.	P	TA	V	Pc.	Nr.	Males	Females
0-14	95.0	1.2	3.8	100.0	3,367	93.3	1.6	5.1	100.0	3,220	-2.6	-3.5
15-44	92.9	1.8	5.3	100.0	2,315	89.9	2.7	7.4	100.0	2,721	-3.5	-4.7
45-64	93.7	3.4	2.9	100.0	759	92.5	3.5	4.0	100.0	857	+0.5	-0.5
65 +	93.4	3.5	3.1	100.0	316	92.7	1.5	5.8	100.0	260	+0.4	-4.3
Total (All Ages)	94.1	1.7	4.2	100.0	6,757	91.9	2.2	5.9	100.0	7,058	-2.5	-3.7

Table 3D

Percentages of Present Residents (P); Temporary Away (TA); and Visitors (V) According to Age. AREA IV

Age	Males					Females					TA - V	
	P	TA	V	Pc.	Nr.	P	TA	V	Pc.	Nr.	Males	Females
0-14	94.1	2.5	3.4	100.0	3,337	93.8	2.1	4.1	100.0	3,220	-0.9	-2.0
15-44	91.0	4.4	4.6	100.0	2,424	87.5	5.4	7.1	100.0	2,793	-0.2	-1.7
45-64	92.7	4.9	2.4	100.0	709	90.7	4.9	4.3	100.0	609	+2.5	+0.6
65 +	90.1	6.8	3.1	100.0	292	88.3	7.6	4.1	100.0	290	+3.7	+3.5
Total (All Ages)	92.7	3.6	3.7	100.0	6,762	90.8	3.9	5.2	100.0	6,912	-0.1	-1.3

large common factor, namely persons classified as present residents of the areas in which they were enumerated; making up some 90 percent or more of each final total in all areas. The estimated differences are wholly the result of differences between the estimated number of visitors (included in the de facto figure) and of absent residents (included in the de jure figure).

A further examination of the patterns of the de jure, de facto and the comprehensive populations was carried out by grouping respondents by age. It is significant to note that the excess of absent residents over visitors occurs mostly among those aged 65 and above. While this incidence varies, a pattern of absenteeism concentrated in the older age group is apparent and suggests the possibility of a correlation between absent members of the household and old age.

Almost without exception, the number of visitors to all of the four areas are much greater than the residents who are temporarily away from their respective areas, and the influx of visitors is much higher for Areas II and III than Areas I and IV. It is also clear from the tables that females are more frequent visitors to the project areas than males: there is evidence of sex differential in the pattern of visitors over absent residents.

4. (i) Age and Sex Composition (Tables 4A-4C)

An analysis of age and sex composition of the population under consideration is also part of the basic demographic profile. Information on age structure is also essential in investigating basic factors of population change, such as fertility, mortality and migration.

Table 4A

Summary of the Percentage Age/Sex Distribution in Areas I, II, III and IV

by De Jure Enumeration

Age Group	Area I			Area II			Area III			Area IV		
	M	F	M+F	M	F	M+F	M	F	M+F	M	F	M+F
Under 5	15.9	16.2	16.1	17.5	18.0	17.7	19.2	20.2	19.7	16.9	17.0	17.0
5-14	32.6	31.4	32.0	28.8	26.6	27.7	30.8	25.8	28.3	32.6	30.2	31.4
15-44	32.1	34.4	33.2	34.3	36.8	35.6	33.9	37.9	35.9	35.5	36.2	35.8
45-64	12.6	12.9	12.8	13.4	13.4	13.4	11.4	12.4	11.9	10.6	12.4	11.5
65 +	6.8	5.1	6.0	6.0	5.2	5.6	4.7	3.7	4.2	4.3	4.2	4.4
TOTAL Pc.	100.0	100.0	100.1	100.0	100.0	100.0	100.0	100.0	100.0	99.9	100.0	100.0
Nr.	5,819	5,497	11,316	5,127	5,038	10,165	6,474	6,642	13,116	6,509	6,549	13,058

Table 4B

Summary of the Percentage Age/Sex Distribution in Areas I, II, III and IV

by De Facto Enumeration

Age Group	Area I			Area II			Area III			Area IV		
	M	F	M+F	M	F	M+F	M	F	M+F	M	F	M+F
Under 5	15.9	16.4	16.1	17.5	18.1	17.8	19.5	20.2	19.7	17.3	17.7	17.5
5-14	32.7	31.0	31.9	28.4	26.3	27.3	30.6	25.8	28.2	32.6	29.8	31.2
15-44	32.1	35.1	33.6	34.8	37.3	36.0	34.3	38.4	36.4	35.6	36.3	35.9
45-64	12.7	12.6	12.6	13.3	13.2	13.2	11.0	12.0	11.5	10.3	12.2	11.3
65 +	6.6	5.0	5.8	5.9	5.2	5.6	4.6	3.7	4.1	4.2	4.0	4.1
TOTAL Pc.	100.0	100.1	100.0	99.9	100.1	99.9	100.0	100.1	99.9	100.0	100.0	100.0
Nr.	5,832	5,533	11,365	5,139	5,200	10,339	6,639	6,901	13,540	6,517	6,641	13,158

Table 4C

Summary of the Percentage Age/Sex Distribution in Areas I, II, III and IV

by Comprehensive Enumeration

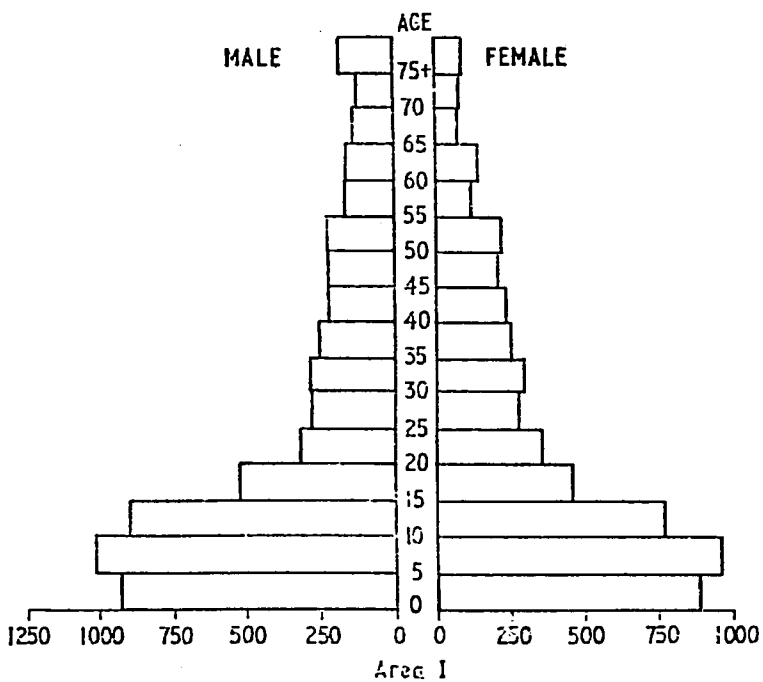
Age Group	Area I			Area II			Area III			Area IV		
	M	F	M+F	M	F	M+F	M	F	M+F	M	F	M+F
Under 5	15.9	16.2	16.1	17.7	18.1	17.9	19.5	20.2	19.9	17.4	17.4	17.4
5-14	32.6	30.7	31.7	28.2	26.0	27.1	30.4	25.5	27.[illegible]	32.0	29.2	30.6
15-44	32.4	35.4	34.0	35.1	37.6	36.3	34.1	38.7	36.4	35.6	36.9	36.2
45-64	12.6	12.7	12.6	13.1	13.3	13.3	11.3	12.0	11.7	10.5	12.3	11.5
65 +	6.5	4.9	5.7	5.8	5.0	5.4	4.7	3.7	4.2	4.4	4.2	4.3
TOTAL Pc.	100.0	99.9	100.1	100.0	100.0	100.0	100.0	100.1	100.1	99.9	100.0	100.0
Nr.	6,114	5,845	11,959	5,375	5,306	10,681	6,757	7,058	13,815	6,752	6,912	13,674

The baseline enumeration of the four areas in the Danfa Project provides information on the distribution of the populations enumerated by sex and age. Persons registered in the survey were distributed by sex among seventeen age classes as follows--Under 1, 14, 5-9, . . . 65+. Detailed tabulations have also been made by single years. Published information on age is also available for each illage and for smaller social units with which we are not concerned here. A summary percentage distribution of age groups of the study population is shown in Tables 4A-4C.

A few observations can be made about the age/ sex distribution of the four study areas. The proportion of a population less than 15 years old is a fairly reliable index of birth rates provided birth rates have been reasonably constant during the preceding 40 to 50 years--fertility rather than mortality is the principal determinant of a population's age structure. From the evidence in Tables 4A-4C, the study population shares with Ghana and many developing countries a consistently high birth rate as they exhibit a correspondingly high percentage of persons recorded under fifteen years. The de jure enumeration of those under 15 in Areas I, II, III and IV resulted in figures of 48.1%, 46.2%, 48.0% and 48.3%, respectively. Similarly, the proportion of the total populations aged 65 and above for the four Areas I, II, III and IV are 6.0%, 5.6%, 4.2% and 4.4% respectively. The percentages under fifteen and sixty-five and over by both de facto and comprehensive enumeration are similar. Similar comments can be made about the comprehensive type population in Table 4C.

(ii) Age/Sex Pyramids (Tables 5A-5C, 6A-6B, 7, Figures 1-2) A very effective and widely used method to graphically depict the age/sex composition of a population is the age/sex pyramid. The basic pyramid consists of bars representing age groups in ascending order, pyramided horizontally on one another. Figures 1 and 2 show the population pyramids for the project areas by the de jure and de facto enumerations. It is often possible to infer a good deal about the demographic history of the areas by examining the population's age/sex pyramid.

A pyramid does not identify specific demographic factors which have shaped it, and does not explain how factors act in unision to determine the number of persons at each age. However, inferences can be made about the demographic history of populations represented in an age/sex pyramid. Broad patterns can be discerned from Figures 1 and 2. The pyramids for the four project areas all have a very broad base and narrow very rapidly; this illustrates the case of an age/sex structure with a very large number of children, a very small proportion of elderly persons and a low median age, i.e. a relatively "young" population. This also suggests a population with a relatively high birth rate in the recent past. The generally triangular shape and concave sides of the pryamids suggest a combination of high birth rates and high death rates. In general, the pyramids are smooth but minor irregular variations in the length of the bars may point to past fluctuations in the number of births or in the volume of migration in the relevant age groups. Heavy migration or immigration is not suggested by Figures 1 and 2.



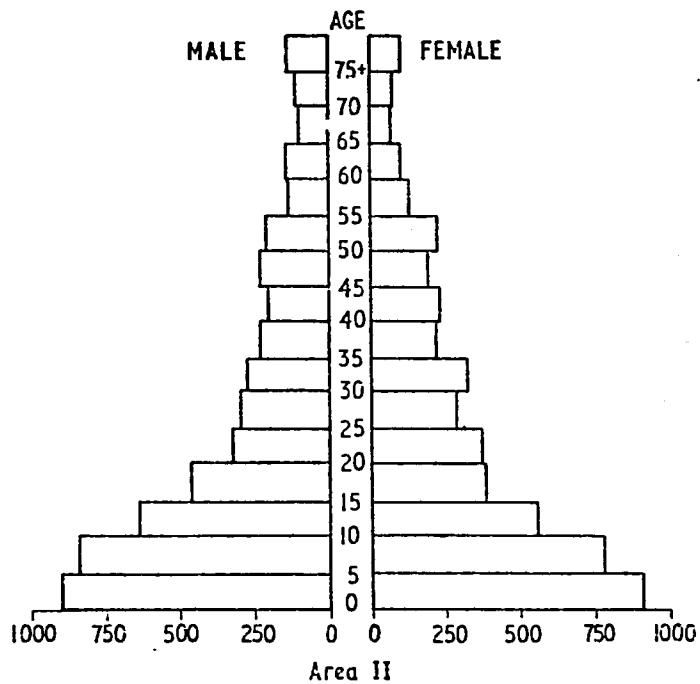


Figure 1 AGE/SEX DISTRIBUTION BY DE FACTO AND BY PROJECT AREAS

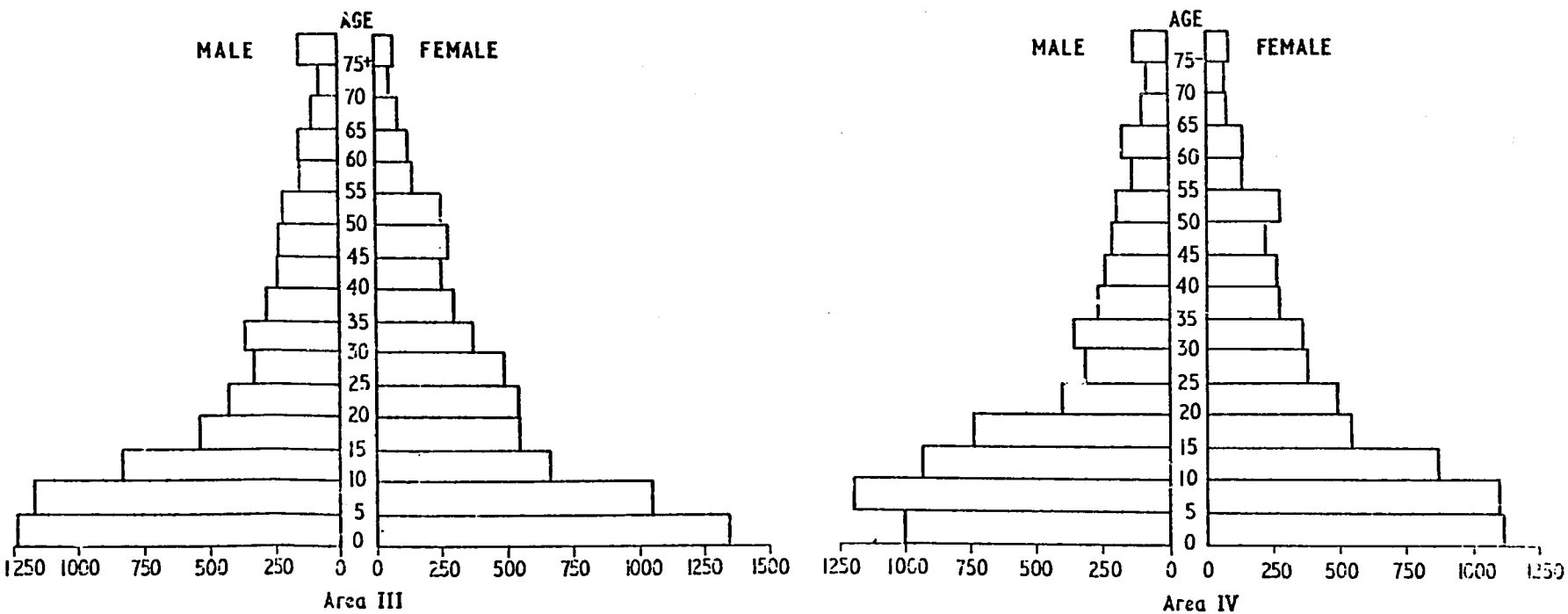
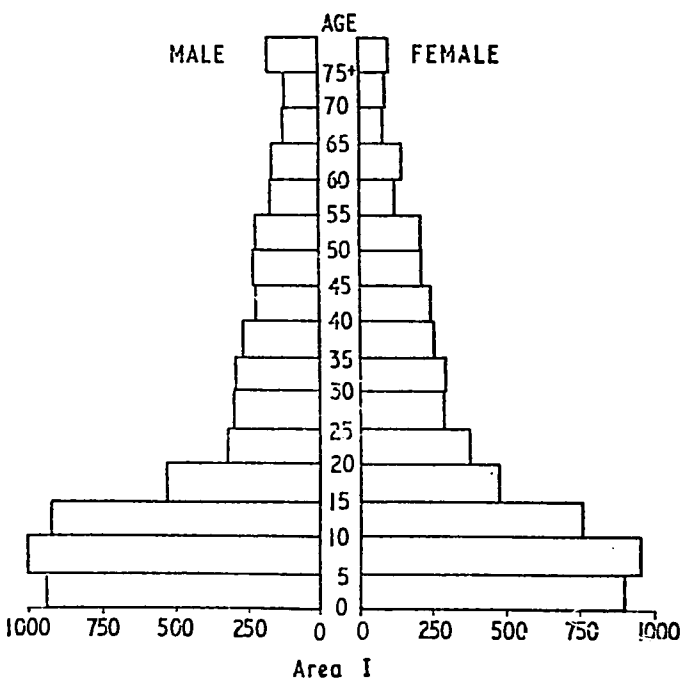


Figure 1 AGE/SEX DISTRIBUTION BY DE FACTO AND BY PROJECT AREAS

Figure 2 AGE/SEX DISTRIBUTION BY DE JURE AND BY PROJECT AREAS



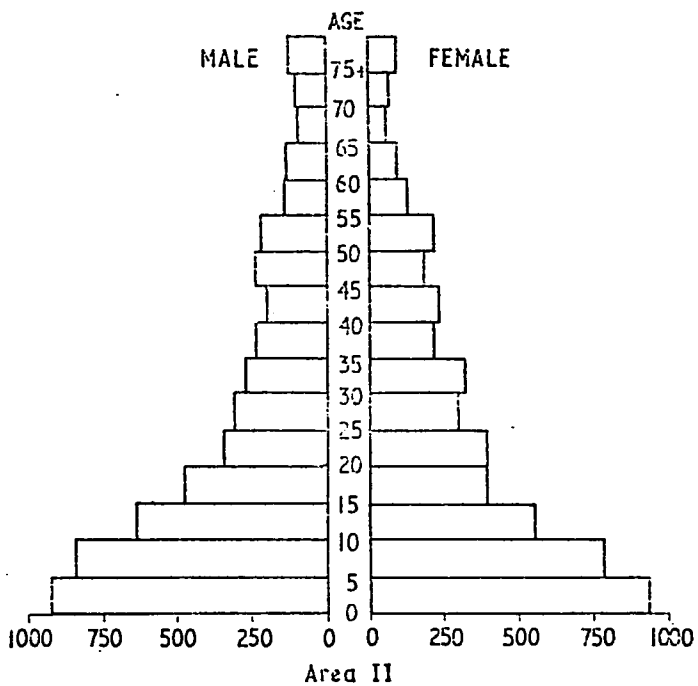
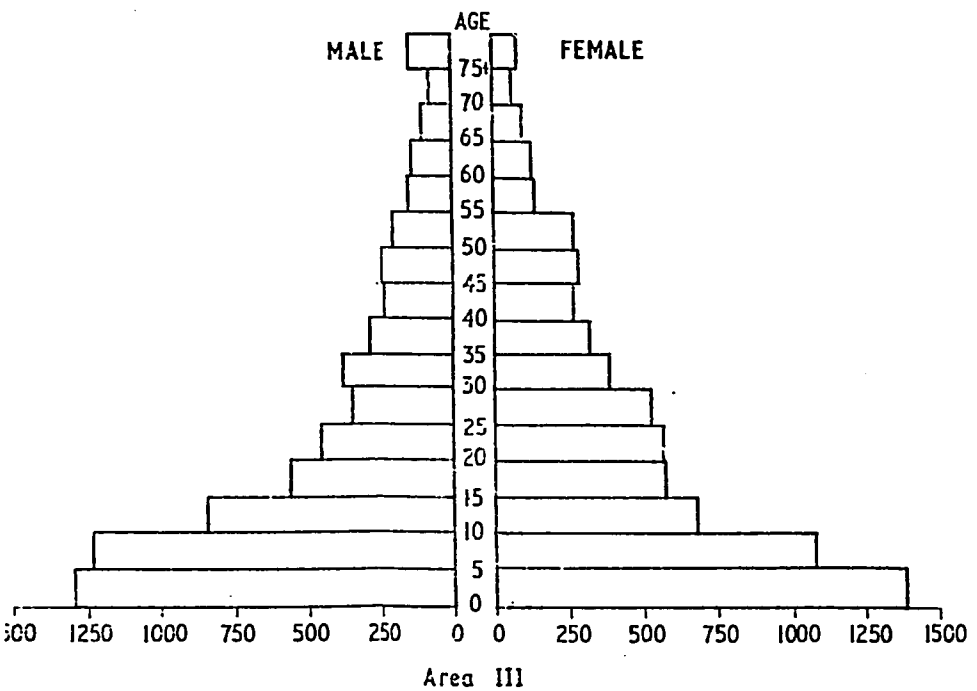
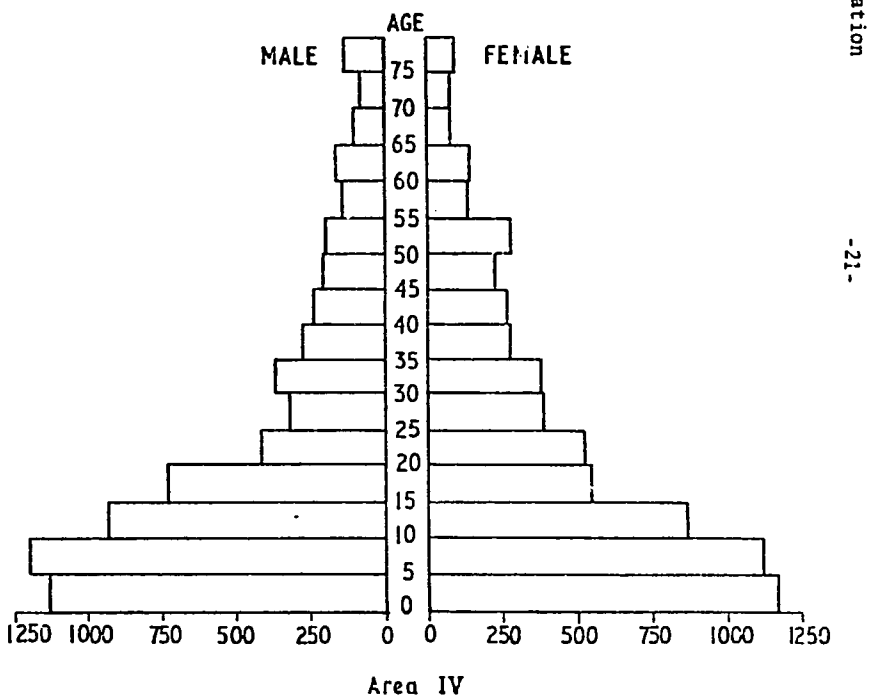


Figure 2 AGE/SEX DISTRIBUTION BY DE JURE AND BY PROJECT AREAS



Area III



Area IV

A summary of the essential features of the population is shown in Tables 5A to 5C for both the de jure and de facto methods. Age dependency ratios are also estimated. This ratio represents the ratio of the combined child population and aged population to the population of intermediate age and reflects the burden of dependency which the productive population must bear. Differences in these ratios are principally related to differences in the proportions of children and hence to differences in fertility rates.

The median ages* for all the four areas have also been estimated under the three types of population enumerations as shown in Table 5A. One striking observation is that the median age for females is consistently higher than the median age for males in all four areas. These median ages, however, compare favorably with the median age estimated for the whole of Ghana in 1960 which was reported as 18.4 years (ref.). One can therefore conclude that the populations in the project areas are "young" populations.

(iii) Index of Relative Difference

The magnitude of the differences between any two age distributions whether for different areas, dates or population subgroups may be summarized in single indexes from the individual age-specific indexes:

*Defined as that age which divides the population into two equal size groups.

Table 5A

Median Ages for De-Jure, De-Facto and Comprehensive Populations for Areas I, II, III and IV

Type	Area	I			II			III			IV		
	Sex	M	F	M+F	M	F	M+F	M	F	M+F	M	F	M+F
De-Jure		15.8	16.2	16.0	17.1	18.5	17.8	15.0	17.4	16.2	15.2	16.7	16.0
De-Facto		15.8	16.6	16.2	17.2	18.6	17.9	15.0	17.4	16.2	15.0	16.5	15.8
Comprehensive		15.8	16.8	16.3	17.3	18.8	18.0	15.1	17.6	16.3	15.0	17.0	16.0

Table 5B

De-Jure Population

Summary of Measures of Age Composition for the Four Areas I, II, III and IV

Area	Median Age	Under 15	15-64	65+	* Age Dependency Rate
I	16.0	48.1	46.0	5.9	117.7
II	17.8	45.4	49.0	5.6	104.4
III	16.2	48.0	47.8	4.2	109.1
IV	16.0	48.3	47.3	4.4	111.1

Table 5C

De-Facto Population

Summary of Measures of Age Composition for the Four Areas I, II, III and IV

Area	Median Age	Under 15	15-64	65+	Age Dependency Ratio
I	16.2	48.0	46.3	5.7	116.5
II	18.0	45.2	49.2	5.6	103.2
III	16.3	48.0	47.9	4.1	108.9
IV	16.0	48.7	47.2	4.1	111.8

$$* \text{ Age Dependency Ratios} = \frac{P_o - 14 + P_{65+}}{P_{15} - 64} \times 100$$

$$\text{Index of Relative Differences } \frac{1}{2n} \frac{r_{2a}}{1a} \times 100 - 100$$

where n is the number of age groups, (r_{1a}) is the percentage distribution in a reference standard; (r_{2a}) is the percentage distibution in a given area. In this particular example, the age structure for Ghana's population was selected as a base and each of the age distributions for the four areas were referred to it. Using the 1960 age distribution as a standard, this formula has been applied to the combined male and female age distributions for all the project areas using the comprehensive, de facto and de jure enumeration to determine any substantial differences in the patterns of age distributions from area to area.

Table 6A shows comprehensive enumeration results of the combined male and female age distributions for all the project areas, together with the 1960 age distributions. Similar indices occurred for de facto and de jure enumerations.

The results show a similarity of age structure in Areas II and IV; whereas, a disparity of age structure exists between Areas I and II and between Areas I, III and IV. All the age structures basically differ in configuration from the 1960 Ghana age structures.

5. (i) Accuracy of the Age Data*

Most of those interviewed in the inquiry were illiterate and unfamiliar with schemes for dating events or reckoning ages.

*Age was defined in terms of the age of the person since last birthday and in completed years, months or days.

Table 6A

Age Distributions for Areas I, II, III and IV
Ghana (1960)

Age Group	r_{1a} Ghana (1960)	r_{2a} Area I	Area II	Area III	Area IV
Under 5	19.3	16.1	17.8	19.9	17.5
5 - 14	25.2	31.9	27.3	28.2	31.2
15 - 24	16.8	14.8	15.7	15.9	16.9
25 - 34	16.0	10.3	11.7	12.1	11.0
35 - 44	10.2	8.4	8.7	8.2	8.0
45 - 64	9.4	12.7	13.2	11.5	11.3
65 +	3.1	5.8	5.6	4.2	4.1
TOTAl	100.0	100.0	100.0	100.0	100.0

Table 6B

Estimation of Index of Relative Difference

Age Group	Ghana (1960) (r_{1a})	Area I	II	III	IV
			$\left\lvert \frac{r_{2a}}{r_{1a}} \times 100 - 100 \right\rvert$		
Under 5	19.3	16.5	7.8	3.1	9.3
5 - 14	25.2	26.6	8.3	11.9	23.8
15 - 24	16.8	11.9	6.5	5.4	0.6
25 - 34	16.0	35.6	26.9	24.4	31.3
35 - 44	10.2	17.6	14.7	19.6	21.6
45 - 64	9.4	35.1	40.4	23.3	20.2
65 +	3.1	87.1	80.6	35.5	32.3
$\Sigma \left\lvert \frac{r_{2a}}{r_{1a}} \times 100 - 100 \right\rvert$		230.4	185.3	122.0	139.0
$\frac{1}{14} \Sigma \left\lvert \frac{r_{2a}}{r_{1a}} \times 100 - 100 \right\rvert$		16.5	13.2	8.7	9.9

As in other surveys/censuses in Africa, the enumerators attempted to relate some previous phase or event in a person's experience to some historical event known to the respondent. Clues to the approximate ages of women were also provided by their marriages and maternity histories. Such an approach can lead, however, to an upward or downward bias in the age estimates. In spite of the instruction to the enumerators to refer to some objective basis for age estimation, it would be presumptious to claim that this was always done. The procedures outlined for use in the survey were timeconsuming, and it is likely enumerators at times judged the age impressionistically from physical appearance. Analysis of the number reported at single years indicates that numbers enumerated with digits ending in 0, 5, 2 and 8 were large compared to others ending with other digits and indicating some degree of age heaping.*

The main factors which have probably produced a distorting effect on the observed age composition in the four areas are--

(a) Age-selective migration,

(b) Erroneous enumeration, and

(c) Age mis-reporting

The method used in correcting this type of error is known as Myer's procedure.** This index reflects respondents' preferences or dislikes

*Age heaping is an unbiased error in which the average age will be correct since people who overstate their ages are expected to counteract the effect of those who understate it. An inspection of the tabulated age distributions by single years shows that this type of error has occurred to varying extents in all the four study areas. The respondents show a tendency to round their ages with digits ending in 0, 5 and 2.

A second type of error-age-shifting also involves a bias in the reported (?) age structures. This feature probably occurs at the older ages where status and age are often highly correlated and many individuals may overstate their age. These shifts in the ages are not easy to detect and are difficult to measure even approximately with a view to correction.

**The method was applied to ages 10-69 years.

for each of the ten digits from zero to nine. The procedure is as follows: Let U_k^p be the number of persons in a population at ages in singles years (starting at p) with final digit k, p is taken to have zero as final digit at the starting point. Myer's "blended" population can then be used where $kU_k^p + (10 - k) U_k^p + 10$ for each digit is expressed as proportion of the sum of all digits and compared with the expected ten percent. The deviations from ten are summed irrespective of sign to obtain Myer's index. Theoretically Myer's index can vary from 0 to 180; for example, if ages are reported accurately, all "blended" sums are very nearly equal and deviations from ten percent are negligible and almost zero; on the other hand, if the preference or dislike centers on one particular digit, the percentage distribution will be zero at all digits and one hundred at this particular digit; thus making the sums of the deviations from the expected ten percent total up to one hundred and eighty percent. The application of this procedure to the age data collected in all the four areas is presented in Table 7 along with similar analysis from Ghana and U.S.A. for comparative purposes only.

Clearly there are noticeably positive deviations which are recorded at digits 0, 5, 2 and 8. In the enumeration of the base population, the data from Table 7 suggests that 27.3% males and 28.5% females in Area I reported themselves with ages ending in digit 0 or 5, against an expected 20%. The corresponding figures for Areas II, III and IV are 28.4% for males and 30.8% for females, for Area II 25.8% for males and 27.6% for females, for Area II 24.9% for males and 26.9% for females. There were also very slight preferences for digits 2, 6, and 8. Thus we find that in Area I 31.4% males and 35.9% females reported themselves with digits ending in these figures against an expected 30.0%.

Table 7

Myer's Indices for Examining Digit Preference

for the Four Areas; Ghana 1960 and U.S.A. 1960

Terminal Digit	Area I		Area II		Area III		Area IV		Ghana+ 1960		U.S.A.* 1960
	M	F	M	F	M	F	M	F	M	F	ALL
0	14.0	16.3	14.4	17.4	13.5	14.4	13.0	15.1	20.8	21.7	9.9
1	7.7	6.2	8.2	7.5	8.0	7.7	8.6	8.2	6.4	6.4	9.9
2	10.3	11.3	9.9	10.3	11.8	10.7	11.2	11.9	9.9	10.0	9.9
3	8.2	8.9	8.3	8.7	8.8	7.9	8.6	9.5	6.4	6.3	9.8
4	9.8	10.6	9.0	9.2	9.6	8.6	9.5	9.5	8.0	8.0	10.1
5	13.3	12.3	14.0	13.4	12.3	13.2	11.9	11.8	13.6	13.0	10.3
6	10.8	9.8	9.7	10.2	8.7	10.3	10.2	10.7	9.5	9.4	9.9
7	9.1	7.2	7.9	6.1	8.5	6.6	8.7	7.0	6.9	6.4	10.1
8	10.3	12.3	10.9	10.7	11.2	12.3	10.4	10.4	11.0	11.4	9.8
9	6.5	5.1	7.7	6.4	7.6	8.2	8.0	5.9	7.9	7.4	10.1
Myer's Index	17.4	25.6	18.6	24.1	17.6	21.9	13.3	14.7	30.8	32.2	1.4

Sources:

+ (1) Kpedekpo, G.M.K. "The Extent and Nature of Errors in the 1960 Ghana Census" J.W.A.S.A., Vol. 12, No. 2, pages 149-163 (1967).

(2) Kpedekpo, G.M.K. "A note on the Evaluation of the Age Data in the 1960 Ghana Population Census" J.W.A.S.A., Vol. 13, No.1, pages 127-134 (1968)

* Methods and Materials of Demography, Vol. I, U.S. Department of Commerce, Bureau of Census, Shryock H.S. et al. Page 208, Table 8.4.

The figures for other areas deviate slightly from the expected percentages in Areas II, III and IV. The odd digits are the least preferred: 1, 3, 7 and 9 digits show 31.5% and 32.1% for males and females reported ages ending in these digits against an expected 40.0%.

The magnitude of the preference indices reveal sex differentials in digital preference or dislike. On the whole, female indices are higher than male indices, an indication that age reporting is probably more accurate for males than females in the four areas. The level of these indices compared to others obtained in Ghana (1960) suggest that the recording of ages was reasonably accurate during the enumeration.

(ii) Sex and Age Ratios

The accuracy of age reporting was further examined by studying the pattern of sex and age ratios in the four areas. The method was essentially an estimation of sex and age ratios for five years groups and the calculation of joint sex/age ratio scores for all the areas. The sex ratio is number of males per 100 females; the age ratio is defined as the population in the particular age group over the mean of the populations in the two adjacent age groups.

This kind of analysis is based on the assumption that the number of persons of one age group is closely associated with the average number of persons in each adjacent age group. A perfect age distribution then, assuming there is no major external migration would be exactly 100. A ratio under 100 suggests the group was underenumerated or that persons were reported in the wrong age group (or both), and a ratio over 100

suggests over-enumeration of the particular age group or that persons were mistakenly reported in the wrong age groups (or both).

The sex ratios for the five-year groups or the age-specific sex ratios of the project population show some marked peculiarities which strongly suggest reporting errors on the whole. The sex ratios by ages reflect to a large extent differential under-enumeration and age misreporting by sex. The pattern is, however, characteristic of many censuses and surveys in other African countries. An African sex ratio model which was constructed on the assumption that the age structure is shaped by fertility and mortality alone was used for comparison. The comparison revealed a marked and sharp decrease in sex ratios of ages 2034 probably due to the greater prominence of the female bulge in this age group and/or to migration movements. On the whole, age misreporting varied in extent at the different parts of the age span. Most of these errors may be associated with age but migration may also be a contributing factor. Sex and age ratios are also subject to large fluctuations when the numbers used in their estimation are small, as may be the case here.

Table 8A

Patterns of Sex Ratios (Male/Female) for Children Under 1 Year Old in the Project Areas

Type of Enumeration	Area I	Area II	Area III	Area IV
1. De Jure	103.3	97.4	84.6	95.4
2. De Facto	106.6	95.1	86.1	93.8
3. Comprehensive	104.7	96.6	85.1	94.4

Table 8B

Patterns of Sex Ratios for Ages 0-4 Years in the Project Areas - Comprehensive Population

	Area I	Area II	Area III	Area IV	Expected Sex Ratio
Comprehensive Type Enumeration	103.0	98.0	92.0	98.0	101.5

Table 8A show the sex ratios for the under-one-year olds by different types of population enumeration in the four areas. Theoretically, one would expect a sex ratio of 104 for all children under one year of age, if the sex ratio at birth were 105; and one would expect the sex ratio of 101 males per 100 females, if the true ratio at birth were 102 males per 100 females. It is clear from Table 8B that the recorded sex ratios for ages 0-4 are very low except in Area I. In the 1960 and 1970 Ghana Census enumerations, the sex ratios in the 0-4 age group were 98 and 99 respectively. The results indicated in Tables 8A and 8B would tend to imply some inconsistency in the data, and suggest selective under-registration

and/or an evidence of migratory movements which could distort the pattern of sex ratios. Also possible are the explanations that either the sex ratio is actually low or that male infant and early childhood mortality rates may be much higher than female rates.

Table 9 summarises the age and sex ratios scores as well as the joint scores by the four areas by the 3 types of enumeration. In the case of the sex ratios successive differences between one age group and the next are noted and their average is taken irrespective of sign; similarly for age ratios, deviations from 100 are noted and averaged irrespective of sign. For the joint scores, three times the average of the sex ratio differences is added to the two averages of deviations of age ratios for males and females to obtain the index. It should be noted that these indices are for use in comparing the accuracy of age reporting. It must also be noted that the larger the joint score the more accurate are the results. The large value of the scores may be due to the effect of migration on the age/sex composition. Or it could be influenced by the small numerical sizes of the population when classified into the fiveyear age groups. Ratios in general are sensitive to small numbers and could fluctuate erratically. The value of the scores does not, in our view, preclude the earlier conclusion that the reporting of ages by single years is reasonably accurate.

Table 9

Age and Sex Ratio Scores and Joint Scores for Three Types of Population Enumeration

Population Type	Area	Sex Ratio	Age Ratio Score		Joint Score
			Males	Females	
Comprehensive Population	I	12.0	11.0	15.0	62.0
	II	17.0	9.3	16.0	76.3
	III	14.0	10.4	10.5	62.9
	IV	14.0	14.3	16.5	72.8
De-Jure Population	I	11.0	11.0	13.6	57.6
	II	23.0	10.0	17.3	96.3
	III	14.0	11.0	13.0	66.0
	IV	15.0	15.0	15.5	76.0
De-Facto Population	I	12.0	11.0	13.2	60.2
	II	18.0	9.0	16.0	79.0
	III	14.0	10.0	10.7	62.7
	IV	15.0	13.6	16.2	74.8

6. Estimates of Child-Woman Ratios from the Age Distributions by Type of Enumeration

Where data are scanty and defective, all possible sources of data must be used to estimate basic demographic characteristics. At least two measures of fertility are frequently available from census reports:

(i) the ratio of children under five years to women in the child-bearing ages (the "child-woman" ratio)

(ii) the estimates derived from reports by women of children ever born and births during the previous year.

In the Baseline Survey, item (ii) was not requested from respondents and measures from this source area are/was not available from the project's fertility survey. The "child-woman ratio," however, can be estimated from the available data.

Table 10

Child-Woman Ratio for the Four Areas According to De Jure or De Facto Population Enumeration

	De Jure Population		De Facto Population	
Areas	$\frac{P_{(0-4)}}{P_{f(15-49)}} \times 1000$	$\frac{P_{(5-9)}}{P_{f(20-54)}} \times 1000$	$\frac{P_{(0-4)}}{P_{f(15-49)}} \times 1000$	$\frac{P_{(5-9)}}{P_{f(20-54)}} \times 1000$
I	865	1,051	854	1,033
II	877	857	875	840
III	923	884	920	868
IV	852	984	869	973

Unlike the birth rate the child-woman ratio does not require data secured through the vital registration system. The measure can be obtained from one single census or enumeration. It is, therefore, useful for

measuring fertility of populations where systems for registering births may either be lacking or defective. We can also compute from the same census of age-sex distributions, a ratio of children aged 5-9 to women aged 20-54, which gives a measure of fertility for an earlier quinquennium. Furthermore, children in the 5-9 age group are often more completely enumerated in a census than children under 5 years of age.

The ratios shown for these two measures show some discrepancies. In a number of cases, the ratio based on children 5-9 is higher than that based on under 5 at the same census suggesting more thorough enumeration of the older children, although effective fertility may also be falling in some cases. There are a number of advantages to the child-woman ratio as an indirect measure of fertility. It avoids dependence on any arbitrary factor. The time reference implicit in using proportions of children under 5 years--namely the five years prior to the survey--provides a somewhat firmer basis for estimating general levels of fertility than the experience of one year. Finally, in spite of the reliance on estimates of child mortality required for this procedure, it is perhaps less vulnerable to serious bias than reports on births during the previous year.

However, the possible effects of migration and differential under enumeration in the areas surveyed should be noted, but where women move with their children the ratio is unlikely to be affected. The cumulative force of mortality and perhaps net migration is greater among older children, so that, other things being equal, there is a greater understatement of the number of births in which the children survive. Both

the numerator and the denominator are affected but rarely to the same extent, so the cancelling of error may only be partial.

(i) The total de jure population for all the four areas was 47,655; 23,929 males and 23,726 females. The de facto population was 48,402; 24,188 males and 24,214 females. The total comprehensive population was 50,127; 25,006 males and 24,121 females. These population figures indicate a general sex ratio of 100.8 males per 100 females for the de jure type population, 99.9 and 99.5 per 100 females for de facto and comprehensive population respectively

(ii) The estimated de jure and de facto populations have a large common factor, namely, persons classified as present residents of the areas in which they were enumerated 90 percent or more of each final figure. The differences, therefore, are wholly the result of differences between the estimated numbers of visitors (included in the de facto figure) and of absent residents (included in the de jure figure).

(iii) In all the areas, the visitors group out-numbers the absent-resident group. However, the possibility of differential under-enumeration of some elements in the population is suggested by the discrepancy between the de jure and de facto estimates of the population. This is perhaps due to the fact that there is an inherent difficulty of complete enumeration of persons temporarily absent and persons recently settled in localities.

(iv) An evaluation of the age data suggests that they were affected by possible age selective migration, erroneous enumeration (age-selective

omissions, possibly in the 04 age group as shown by the pattern of the sex and age ratios in this age group) and age misreporting as revealed by Myer's analysis of digital preference. Changing fertility and mortality may also have caused some distortion in the shape of the age distribution.

(v) The reported age distributions by sex for those under 15 years for all areas are over 45.0% which indicates a history of high fertility in the project areas. The median age is around 17.0 with minor variations around this figure indicating that the population surveyed is young. An analysis of the shape and configuration of the age distributions by the use of index of relative difference method suggests that Areas III and IV have almost the same configuration and are both different from Areas I and II.

(vi) The pattern of "child-woman ratio based on $\frac{P_{(0-4)}}{P_{f(15-49)}}$ as a measure of relative fertility performance of the four project areas suggests that Area III has the highest fertil :y (if the quality of enumeration is the same in all four areas). On the other hand, if the calculations are based on $\frac{P_{(5-9)}}{P_{f(20-49)}}$ the estimates would suggest that Area had a higher fertility for an earlier quinquennium. There are difficulties created by the quality of enumeration or coverage errors in interpreting these figures. However, it we accept that the coverage errors are almost the same, it could also be deduced that effective fertility may be falling faster in some areas than others.

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