ESTIMATING FERTILITY AND CHILDHOOD MORTALITY FOR THE WESTERN REGION OF GHANA FROM PREGNANCY HISTORY DATA

by

Kofi Awusabo-Asare

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D E C L A R A T I O N

Except where otherwise indicated, this thesis is my own work.

(Kofi Awusabo-Asare)

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ABSTRACT

This study basically aims at estimating fertility and childhood mortality rates for a rural community in the Western Region of Ghana using the pregnancy history method. The method was found to have a few advantages over other indirect methods used for estimating fertility and childhood mortality. However, pregnancy history data suffer from under-reporting, event misplacement and age mis-statement errors; and these off-set some of the advantages of the method.

The observed rates from the study area gave an implausible impression of a rise and fall in fertility and childhood mortality in the last 15 years preceding the survey. This feature is believed to be associated with event misplacement errors.

The reported data was smoothed using the moving average procedure. Age-specific fertility rates among younger women were found to be declining in the last 10 years preceding the survey; and this was believed to be related to the impact of formal education. Fertility in the area was high and constant over the the last 15 years prior to the survey. Total fertility rate for the last 5 years was estimated to be about 6.1 per female.

Childhood mortality was under-reported by about 20 per cent. And the infant mortality rates obtained were considered to be implausible as a result of event misplacement and under-reporting errors. In general, both the infant and childhood mortality [q(5)] rates are high but declining. However, the rate of decling could not be categorically stated as a result of errors in the data.

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CHAPTER 1

INTRODUCTION AND BACKGROUND

1.1 AIM AND OBJECTIVES

Recently, some demographic studies in developing countries have focused attention on fertility and mortality changes. Tsui and Bogue (1978), for example, have presented a concise report on the trends, causes and implications of declining world fertility. In their survey of fertility change in 113 countries around the world between 1955-60 and the early 1970s, 29 were observed to have had an increase in total fertility. Ten of these countries were from Africa. Eighty-three had a decrease and only one had no change. The World Fertility Survey has also devoted part of its resources to the study of fertility and mortality changes in developing countries. Results from some of these studies should, however, be received with some caution. For, no historic vital registration systems exist in in a number of developing countries in any reliable form which can give an accurate picture of fertility and mortality trends. Secondly, the available data from these countries have been inadequate and defective. And except in a few cases, most of the methods used cannot detect minor changes, especially, those at the incipient stage of decline, given the assumption of constant fertility that is inherent in the methods.

About a decade and a half ago the United Nations pointed out that "...There is a serious gap between the quantitative information about populations that is essential for many purposes and the amount and quality of data actually available...In developing countries, the registration of vital events is often nearly non-existent or at best only fractional in coverage." (United Nations 1967:1). This situation has not changed much since that period.

This lack of vital events registration data which precludes the use of direct measures has led to the use of sample surveys and indirect methods in deriving mortality and fertility rates. Among the indirect methods widely in use are the stable and quasi-stable population models, Brass' P/F ratios , children ever-born and children surviving, own-children approach, pregnancy history analysis and the widowhood and orphanhood approaches. The present study explores the use of one of these indirect methods, the pregnancy history analysis, in deriving fertility and mortality estimates for rural Western Ghana, an area with no vital events records. The main approach of the method is to collect complete records of respondents' past pregnancy outcomes. This enables fertility and mortality changes to be studied over time from the same source material. The method is being applied to data derived from a longitudinal demographic survey conducted in some selected villages in the Western Region of Ghana in 1974. This study, it is hoped, will not only provide some idea about the past and present fertility and mortality of a rural community in Ghana, but also provide an opportunity to test the pregnancy history method within the context of Ghana.

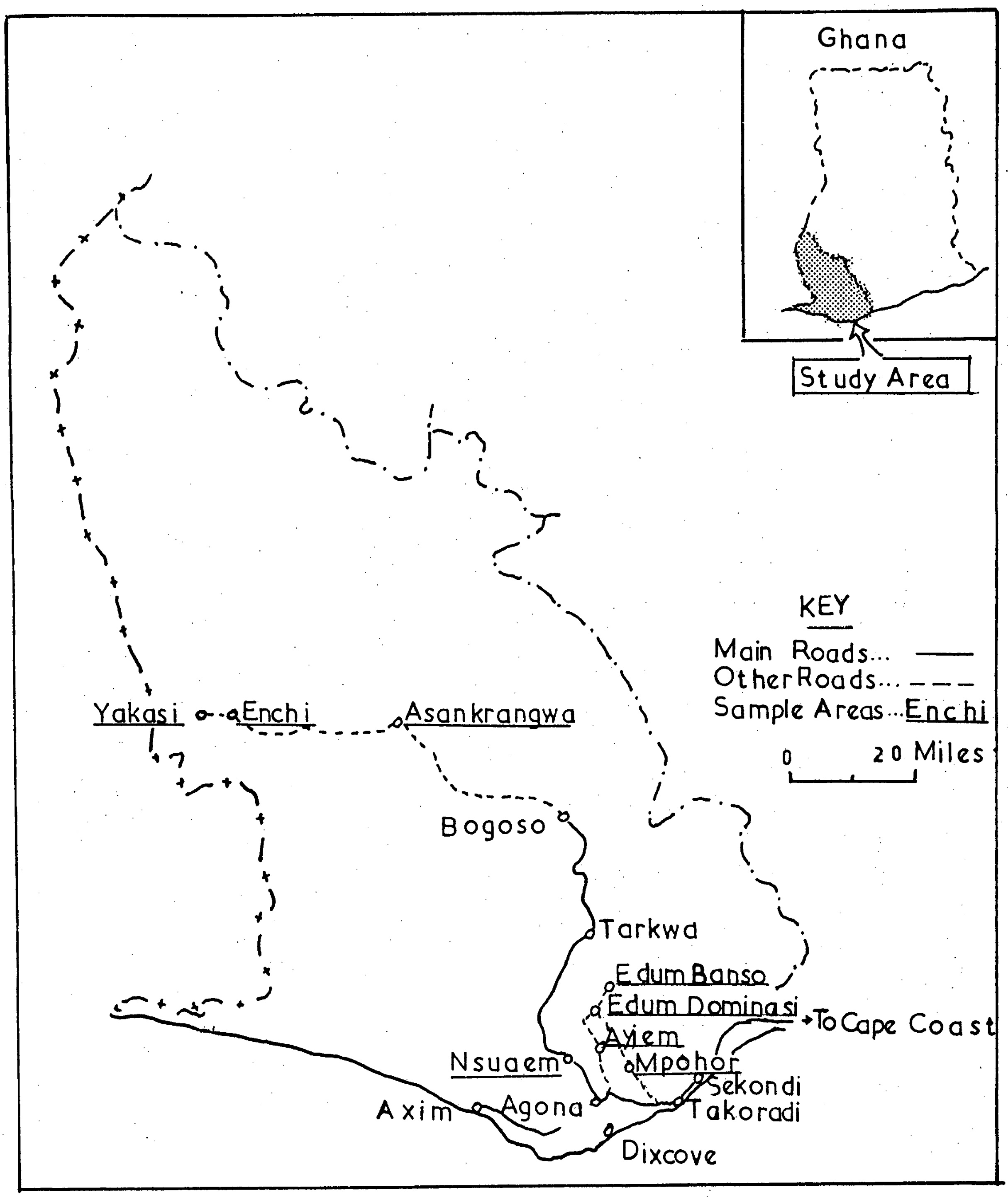
1.2 STUDY AREA

In 1974 the Demographic Unit of the University of Cape Coast (Ghana) initiated a project to collect demographic data pertaining to the rural areas of the Western Region of the country. This region is located in the south-western section of the country, along the border with Ivory Coast to the west and the Gulf of Guinea to the south (Figure 1.1). The region was created in 1963 from the former Western Region which consisted of the present Western and Central Regions. Until 1957, it was known as the Western Province of the Gold Coast.

Climatically, it is the wettest and the most humid area in Ghana. Rainfall recordings show an annual total of between 1500 and 2000mm in most areas and distributed throughout the year. Relative humidity is always about 80 per cent or more. The high rainfall and humidity have combined to give rise to a dense tropical forest. The area is, therefore, one of the major sources of timber and timber products in the country. The climatic conditions and the vegetation support a number of agro-based projects. These include the Mpohor Palm-oil project, the citrus fruits project near Axim and the Rubber Estates of Bonsaso. In addition, the region has one of the richest geological formations in Africa (Boateng 1966:40). It was partly through the gold from this region that the country earned her pre-independence name of Gold Coast. Other minerals mined from the region are bauxite and manganese. Despite the region's endowed natural resources it is one of the least developed areas in the country (Engmann 1973:26). Provision of facilities like electricity, pipe-borne water, hospitals/clinics and surfaced roads are found in the few urban centres and some developed enclaves. None of the survey villages falls into either of these categories.

Figure 1.1

Demography Scheme Sample Areas: Western Region of Ghana



The region is predominantly inhabited by the Akan ethnic group. According to the 1960 Census the Akans formed about 90 per cent of the region's population (Ghana 1964:25). The Akan groups found in the region are the Nzimas, Fantis, Aowins and Wassaws.

For the survey, eight villages were purposefully selected for their "... accessibility ...during the rainy season, their population size and their distance from Cape Coast" (Jain 1978:xi). The populations of these villages ranged from 969, Ayiem, to 5,378 for Asankrangwa (Table 1.1). By Ghanaian statistical definition, the latter settlement qualifies to be a town, which is any settlement with a population of 5,000 or more people. But the town lacks all urban amenities. However, the town serves as an administrative centre due to its size and location within the area. At best it can be described as an 'overgrown village'. The last three settlements, Edum Banso, Edum Dominase and Ayiem are no doubt purely rural settlements. The ethnic composition of the survey area is Wassaw 56 per cent, Aowin, 27 per cent and other Akan groups 12 per cent.

This study is not the first attempt to collect demographic data or undertake a demographic study in the region. Unfortunately, most of the studies have been undertaken as part of a national exercise or restricted to the urban areas. As part of the Western Province of the Gold Coast, the first population count was conducted in the area in 1891. This was followed by counts every ten years until 1931. The 1941 Census, disrupted by the Second World War, was conducted in 1948. The area was covered in the 1960 and 1970 Censuses of Ghana. Busia (1950) conducted a survey on the population of Sekondi-Takoradi, the capital of the region. Though this was done from a sociological standpoint, it was one of the first attempts to look at the demographic composition of the regional capital. Brown (1976) studied the population characteristics of Sekondi-Takoradi in the light of

Table 1.1

Population of Survey Villages

Village	Population	Percentage of Total
Asankrangwa	5,378	25.0
Enchi	4,790	22.3
Mpohor	2,917	13.5
Yakasi	2,407	11.2
Nsuaem	2,233	10.4
Edum Banso	1,531	7.1
Edum Dominase	1,273	5.9
Ayiem	969	4.5
Total	21,493	100.0

Source: Jain (1978) p 2.

Busia's previous observation.

Most of the other demographic studies covering the area have been done as part of national studies. These include Hilton's (1956) study on the distribution and density of the population of the Gold Coast; Gaisie's (1969) work on the fertility levels and differentials in Ghana; Studies in the spatial relationship of the socio- cultural characteristics of the population (of Ghana) by Forde (1966, 1976); and Engmann (1969, 1973 and 1976) on the geographical distribution of population characteristics in Ghana; the 1968/69 National Demographic Sample Survey (NDSS), the 1965/66 Ghana Fertility Survey and the 1963 Rural Fertility Survey. There has not been any long range demographic studies of the rural population in the region such as Golding's (1963) and Hunter's (1967) studies in the Northern and Upper Regions and the Danfa Project in the Greater Accra Region (Sai et al,1972).

1.3 SOURCES AND LIMITATIONS OF DATA

This study is predominantly based on the pregnancy history data from the 1974 survey which was conducted to give baseline information on the population in the survey villages for multi-round surveys. The survey, undertaken with 15th April as the reference date, collected data on individuals, household characteristics and composition, socio-economic and demographic characteristics such as education, occupation, sex, age, religion, ethnicity, marital status and type of marriage, migration and for women 12 years and over, a complete record of their pregnancies.(see Appendix A1 for a copy of the questionnaire.) Twenty-seven pieces of information were collected on each individual in addition to 8 on pregnancies. In general, the project aimed at "... measuring the incidence of mortality and fertility in a rural community of about 20,000 persons in the forested area...." (Jain 1978:xi). Specifically, it covered 21,493 people in 5,030 households with 6,923 females 12 years and over. Of these females, 4,614 were mothers.

The data form the survey, like most demographic data from developing countries, is fraught with errors and biases. These errors and biases can be classified according to their sources, into errors having their origin in sampling, content and coverage. Since the survey was conducted on a non-sampling basis, the first type of error will not be considered here. This does not mean that the non-sampling procedure has no effect on the data especially when one considers its use to cover the region.

Attempts to produce marginals from the data have revealed a number of biases and inconsistencies. One plausible reason for the errors is that instructions to interviewers were not explanatory enough so that the same questions were interpreted differently by different interviewers. Secondly, in some cases, interviewers could not elicit the right information from respondents. In the area, for instance, no distinction is made between the performance of marriage rites and the consumation of marriage. An interview that does not distinguish between the two is likely to classify people whose marriage has not been consumated as living in sexual unions. These two reasons are partly related to the attempt to translate questions from a foreign language to that of the respondent at the time of interviewing. It has been established elsewhere (see Caldwell 1974:5; Ware 1977:16-18) that better responses can be obtained by using printed questionnaires translated into the local languages long before the inquiry than using on-the-spot translations. Thirdly, it was also observed that some interviewers forgot to do recordings in the field and then filled up the blank spaces at home. This was revealed by some of the interviewers when they were confronted by the supervisor about some inconsistencies on their schedules. A number of such fillings may have passed unnoticed. Respondents have also been found to give incorrect answers either through ignorance, such as the answer to age, or misunderstanding the question or deliberately lying to avoid ill-luck to a pregnant woman, bad omen to the family and/or village or taxation (Joseph 1975:328). Age mis-statement is a problem in illiterate societies like the one being studied where the concept of age or date of birth is of no particular significance. As a result the ages of mothers should be accepted with caution. (This will be discussed further in Chapter Two). On the other hand, dates of birth for children aged about ten years and below can be said to be fairly accurate as a result of the use of baptismal certificates and home recordings by parents and other relatives in some of the villages. Some inconsistencies, such as those on migration and education, were corrected at the editing stage by cross-checking with other related information about the same person.

Coverage errors, on the other hand, were reduced to a minimum for two reasons. Educational campaigns through the Social Welfare Department, churches, chiefs and schools made the population aware of the project and therefore willing to co-operate. Secondly, there were checks and re-checks during and after the interviewing to detect duplications and omissions.

1.4 SCOPE OF THE STUDY

Generally, the study addresses itself to two issues:

(1) estimating age-specific fertility and infant and child mortality rates restropectively for 40 years before the survey using pregnancy history data; and

(2) determining the applicability of the method within the Ghanaian situation.

The study is organised into five chapters. The First Chapter deals with the aim and objectives of the study, the area of study, sources and reliability of the data. The pregnancy history method is reviewed in the first section of Chapter Two. In the second section of the chapter, the survey data is evaluated and set out for the analysis of fertility and childhood mortality. The analyses are done in Chapter Three.

In an attempt to get plausible fertility and mortality rates for the area and to assess the reliability of the method, the results are compared with independent sources such as the 1974/77 vital registration data for the same area, and the 1968/69 National Demographic Sample Survey (NDSS) for the rural areas of the Western Region. The fertility and mortality rates observed in Chapter Three are adjusted for under-reporting, age mis-statement and event misplacement errors in Chapter Four. The Fifth Chapter involves a synthesis and a discussion on the whole study.

CHAPTER 2

METHODOLOGY AND EVALUATION OF DATA

2.1 INTRODUCTION

Over the past two and-a-half decades, a number of indirect methods and analytical procedures have been developed, using census and survey data as input, to derive fertility and mortality rates for developing countries. There is no doubt that the development of these methods and procedures has greatly improved the demographic knowledge about these countries, especially those of Africa. Brass' techniques have, for example, provided remarkable breakthrough methodologies in studying the defective and insufficient demographic data in Africa. Caldwell (1974:4) has noted that "... without question these methods [indirect methods] handle bad data surprisingly well."

With the present interest in fertility and mortality change and the evaluation of family planning in developing countries, pregnancy history analysis, the indirect method used in this study, has come into popular use. The World Fertility Survey (WFS), for example, is using this method in the collection and analysis of its demographic data. According to Bogue and Bogue (1970:1)

> "This procedure not only is correct in terms of demographic theory, but also seems to be practicable when put to use under the conditions that exist in the developing countries..."

Some demographers have, however, not shared this optimism about the reliability of (some of) the methods. Seltzer (1973:5), in his overview of demographic data collection cautioned that:

> "... whether one uses data to make decisions affecting policy or action, or to draw conclusions affecting a scientific knowledge, a failure to face up realistically to the difficulties of measurement can only lead one astray"

Without doubt some of the indirect methods have the potential of leading one astray in their conclusions. This has been demonstrated by Potter (1977a:340), in his evaluation of the pregnancy history method. One then needs to look critically at any indirect methods before using them. This chapter therefore examines the pregnancy history method in some detail. Futhermore, the chapter evaluates the available data, and sets it out for the calculation of rates.

2.2 PREGNANCY HISTORY METHOD

2.2.1 Basic Principles

The pregnancy history method was developed to overcome the problem involved in the estimation of fertility and mortality change in the face of inadequate, scanty or non-existing vital events registration. Developed in the 1950s, it has been elaborated upon by Bogue and Bogue (1970), Brass (1971b, 1975 and 1977) and Potter (1975, 1977a and 1977b). The method involves "...a chronological record, for each woman of childbearing age (or a sample of such women) in a population, of each pregnancy she has experienced." (Bogue and Bogue 1970:3).

A distinction can be made between maternity and pregnancy histories, although some authors use the two words interchangeably. Maternity histories refer to the recording of each successive live-birth and what happens to the birth--whether alive or dead-- while pregnancy histories go further to include pregnancies that did not result in live-births such as spontaneous or induced abortions and still-births. Potter (1975, 1977a) uses "birth" instead of pregnancy or maternity histories. In this study "pregnancy history" is used to reflect the type of data collected in the survey.

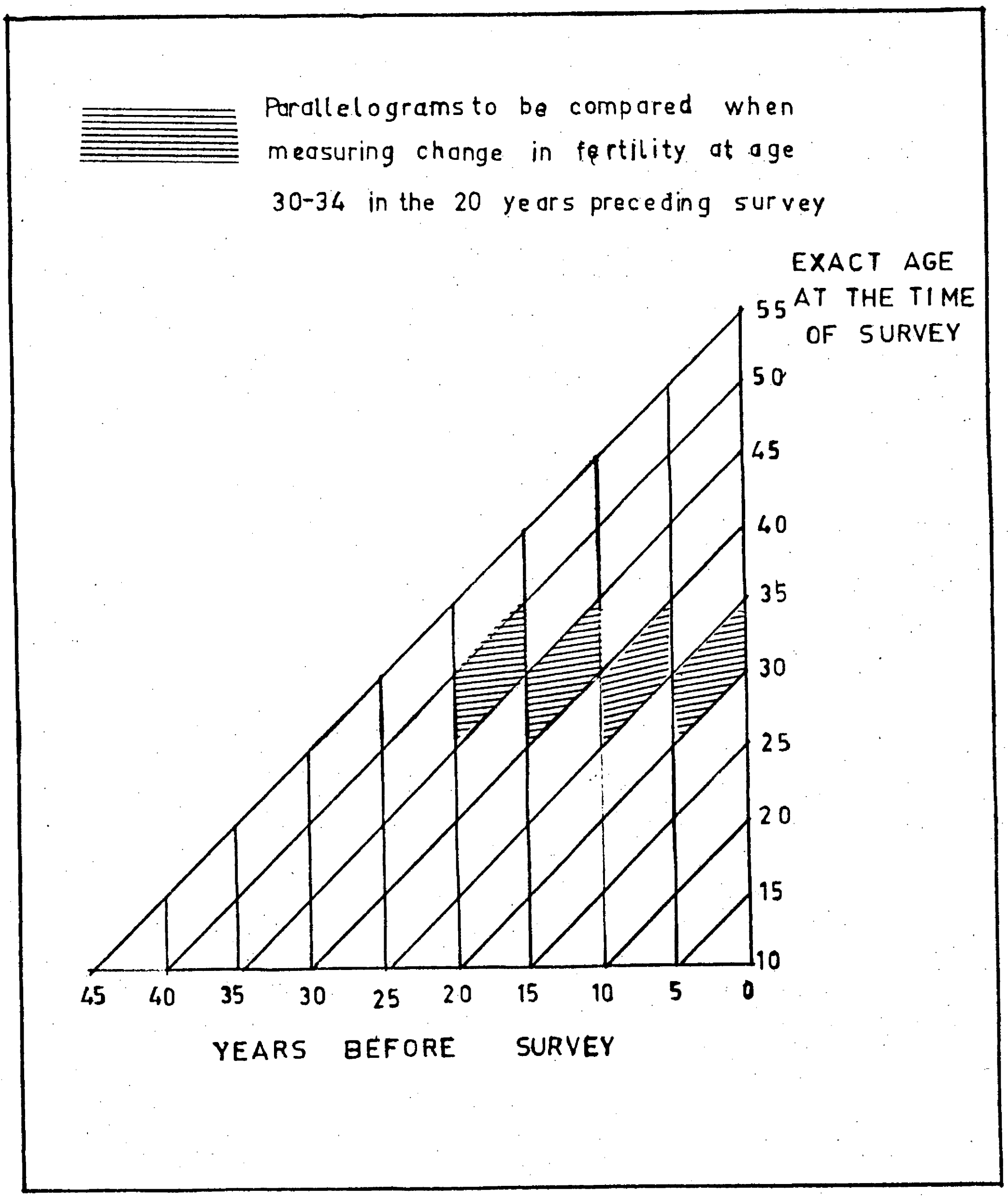
Glass and Grebenik's (1954) report on the 1946 Family Census of Great Britain is the earliest attempt to use the method. In that report completed family size was computed for marriage cohorts from 1910 to 1934. Sheps (1964) used pregnancy wastage to estimate fertility levels. Bogue and Bogue (1967), then used the method to estimate fertility change in developing countries. In 1970 they produced a manual on the method discussing it extensively, and in addition providing computer programmes for editing and calculating fertility and infant mortality rates. Brass (1971b:10-15) pointed out some of the problems inherent in the method using data from Papua New Guinea. In that paper the distribution of first births was used to correct the observed age-specific fertility rates. Hull (1975:205-232), employed the method in a study of the fertility and childhood mortality levels and trends in Maguwoharjo Indonesia. McDonald et al (1976) in their study of the levels and trends of fertility and childhood mortality in Indonesia, used the method and arrived at the conclusion that the results from the pregnancy history survey and from the own-children method applied to the 1971 Census (of Indonesia) did not differ greatly. The most extensive use of the method so far has come from the world round of surveys, the World Fertility Survey (WFS) Project. Published results from these surveys include those of Pakistan (1976), Dominican Republic (1976), Thailand (1977), Indonesia (1978), Sri Lanka (1978) and Fiji (1976), to mention only a few. Apart from ensuring international comparability of results, these studies have provided an insight into some of the problems associated with the method.

Potter (1975:17-44, 1977a:345-347) has evaluated the method for event misplacement (discussed in section 2.3.5), using simulation models and the National Fertility Surveys of El Salvador and Bangladesh. From these data it was shown that the method has the potential of overstating changes in fertility or recognising one when none occurred due to event misplacement. In a similar study of the Fiji Fertility Survey (Potter 1977b:111-117), it was observed that the relatively correct date of birth reporting from the survey justified the use of the pregnancy history method in the collection and analysis of fertility data. The crux of the matter, however, is whether the 'correct' age reporting in the Fiji data can be obtained in most of the countries where WFS is being conducted. The Dominican Republic (1977:4) and Thailand (1978:4), for instance, detected age mis-statement in their data.

Data collection for the method involves the recording of all pregnancy outcomes to a certain category of females, date of birth of each child and date of death of each child if applicable. The recording of the events can be from the earliest to the latest or vice-versa. The information derived from the histories are then tabulated according to number of women by age and period before survey on one hand, and births by age of mother and period before survey on the other. These two tabulations form the numerator and the denominator respectively for the calculation of age-specific fertility rates. Childhood mortality rates are calculated using the number of births and the proportion dying between ages x and (x+n). The resultant rates provide information for the study of fertility and mortality trends. Figure 2.1 shows how one can study fertility change from pregnancy history data.

Figure 2.1

Measuring Fertility Change in Pregnancy History Analysis Using Lexis Diagram



The shaded parallelograms show fertility at age 30-34 in the twenty years before the survey. Changes in fertility among the 30-34 age group (if any) can be revealed by comparing the rates in the periods 15-19, 10-14, 5-9 and 0-4 years before the survey. However, it is in this area of estimating change that one encounters problems.

2.2.2 Merits Of The Method

According to Bogue and Bogue (1970:1), the method is 'correct in demographic theory' in that conventional demographic techniques are applied to the data from the method. Fertility and mortality estimates like age-specific fertility rates, completed family size, parity distribution and childhood mortality can be calculated from the same source material. Also the rates can be calculated for a long period into the past. The method provides data not only for birth cohort populations but also for calendar or cross-sectional ones. As the method involves the complete fertility experience of women it is able to prompt them to remember all pregnancies in their lifetime. It therefore provides an assurance that women will be able to mention all pregnancies and their outcomes. Thus in some developing countries, "...it is possible to collect by direct interview from representative samples of women pregnancy history data that are far more complete and reliable than the data obtained from vital registration system." (Bogue and Bogue 1970:9). The method also has no assumption of constant fertility and/or mortality found in a number of indirect methods.

2.2.3 Biases In The Method

Some of the above advantages work in the opposite direction. Prompting women to remember all vital events in their lifetime may lead to the remembrance of sorrowful or unpleasant experiences which may affect responses. The process of eliciting and recording all events is tedious and time consuming for both the interviewer and the respondent and can easily lead to boredom. The method does not help to measure the fertility and mortality experience of an area of interview if the population has a high proportion of migrants--except where migration history is included. Data from pregnancy histories, like those from children ever-born and surviving, are inadequate for the study of mortality at all ages because of recall lapse among older people.

Bogue and Bogue (1970:9) list three errors inherent in the responses given to pregnancy history questions. These are:

(1) misreporting the date at which pregnancy occurred;
(2) misreporting the age (date of birth) of mother; and
(3) under-reporting of pregnancies.

Age mis-statement has been found to be a drawback on the quality of pregnancy history data from developing countries. Some of the WFS reports, for example, extensively discuss the effects of age mis-statement on observed fertility and mortality rates. The Indonesian survey report remarks that "The [fertility] rates are subject to error due to possible misreporting of births" (Indonesia 1978:58). Under-reporting of events inherent in most retrospective data from less literate societies plagues pregnancy history data as well. "The failure to report all pregnancies weakens estimation arrived at with pregnancy history". (Tsui and Bogue 1978:8).

2.2.4 Measurement Difficulties

Data from pregnancy history analysis enables one to calculate age-specific fertility rates with the relation

$$N_i = \frac{B_i}{P_i^f} \times K$$

where

i = age of woman

N_i = age-specific fertility rate at age i

B_i = births between period t and t+1 to women aged i

P_i^f = female population aged i at mid-point of t and t+1; and

K = a constant, usually 1,000.

Similarly, age-specific death rate between exact ages i and i+1 can be calculated by

$$M_i = \frac{D_i}{P_i} \times K$$

where

i = age of deceased;

M_i = age-specific death rate at age i

D_i = the number of deaths between period t and t+1 to the population aged i;

P_i = the mid-period population aged i between t and t+1; and

K = a constant, usually 1,000.

It has, however, been observed that rates derived by the above calculations are affected by age mis-statement, event misplacement and under-reporting. To correct the observed rates for these errors a number of adjustment procedures have been put forward. Bogue and Bogue (1970:60-90) have written an elaborate computer programme for editing age in 'a non-biasing' correction procedure. The programme is to be used when it is realised that 'correct' age reporting could not be achieved from the interviewing. It should be pointed out that no matter how 'effective' that programme might be, there is an inherent assumption that age mis-statement follows a certain systematic pattern which may not be so in all countries. (see Caldwell 1966 for the case of Ghana).

The Bogues further put forward two procedures for the adjustment of observed age-specific fertility rates. In the first procedure, a 'true' infant mortality rate estimated from independent sources for the same population and the same period is used to adjust the data for surviving births to age 1 in the form

$$B^z = \frac{B_o^z}{1.0 - Q_o^z} = \frac{B_o^z}{S_o^z}$$

where

B^z = the estimated true number of births in year Z

B_o^z = the number of births in year Z who survived to their first birthday;

Q_o^z = estimated 'true' infant mortality rate in year Z

S_o^z = survival factor for year Z=1.0 - Q

(Bogue and Bogue 1970:10)

The adjusted births are then used to calculate age-specific fertility rates and other rates for the population. The challenge then is how to obtain this 'true' infant mortality rate for the population. The whole object of the method is to derive demographic estimates in the absence of a registration system. It therefore becomes questionable how such an input can be obtained for the correction of births. Adjustment for mis-reporting of age of mother is not mentioned in the procedure.

The second alternative involves the reverse-surviving of live-born children still living using life table values to estimate 'true' births. The births are then used as numerators to calculate age-specific fertility rates. This second alternative suffers from all the defects of the reverse-survival method. It is further suggested that the rates from the adjusted births should be considered as 'medium' estimates and those from the unadjusted rates as 'low' estimates. The inflation of the 'medium' estimates by a margin of 5 to 10 per cent gives high estimates.

Brass (1975:44-49) has used the distribution of first births to correct for event misplacement. First births, according to Brass, are better reported than the rest and their timing errors are the same as for all order births. This adjustment makes use of the assumption that the ratio between cumulative fertility and first order births is proportional to 'true' values, that is:

$$\frac{\hat{F}_i}{\hat{F}1_i} = \frac{kF_i}{kF1_i}$$

where

$\hat{F}_i$ = estimated age-specific fertility rate at age i

$\hat{F}1_i$ = estimated age-specific fertility of first births at age i

F_i = true age-specific fertility rate

k = the correction factor; and

Potter (1977a:337) has observed that researchers have not critically looked at the biases in the pregnancy history method, especially, that of event misplacement. Event misplacement of either the date of birth of mother or child or both can lead to various distortions. These are shown in Table 2.1, and graphically shown in Figure 2.2.

The reporting of births earlier than they actually occurred leads to 'younger' distributions of fertility than the real situation. The reporting of events later than the real date of occurrence leads to 'older' fertility distributions. (Figures 2.3 and 2.4). In the latter case one may get a decrease in fertility in the recent adjacent periods before the survey, where none might have occurred or exaggerate minor changes that occurred within the period. The former case presents a situation of increase in fertility within the recent periods. Similar situations can be caused by omissions and age mis-statement. If the proportion of living births omitted from pregnancy history data increased with increase in time, the result will be the reporting of 'younger' fertility schedules. The reverse situation may also occur: if the omission of events increase with decrease in time the reporting of 'older' fertility schedules occur. The latter phenomenon is, however, less likely to occur than the former. The effects of age mis-statement work in a similar way. Under-statement of age leads to 'younger' fertility schedules while over-reporting of age leads to 'older' schedules. Internal consistency checks such as sex ratios at birth and death, and sex differentials in infant mortality may help to reveal the plausible sources of error for the 'older' or 'younger' fertility schedules (Potter 1977a:350-353).

Potter (1977a:345-347) has demonstrated that the assumptions in Brass' (1975:44-49) and Bogue and Bogue's (1970:60-90) adjustment procedures about date of birth mis-statements, under-reporting and the distribution of first

Table 2.1

Event Misplacement Possibilities and Outcomes from Pregnancy History Data.

1.[a] Reference-period Slippage errors.

Respondents tend to misplace events:

(a) toward the date of survey

(b) further into the past

2. Reference-period Size errors.

Respondents tend to:

(a) over-estimate the length of inter-live birth intervals

(b) under-estimate the length of inter-live birth intervals

3.[b] Reference-period Dispersion errors.

Respondents tend to report:

(a) older distribution of fertility

(b) younger distribution of fertility

(c) earlier occurrance of child mortality

(d) later occurrance of child mortality.

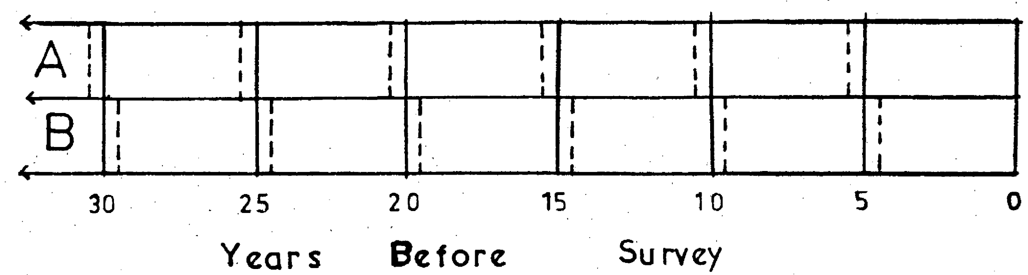
NB Interviewers can similarly contribute to the errors.

Sources: (a) Potter (1977a), p 340.

(b) Brass (1977), p 110.

Figure 2.2

Misplacement of Events Further away from or Close to the Survey Date



A Putting dates of events away from survey date.

B Putting dates of events close to survey date.

Figure 2.3

Younger Reported Distribution of Fertility of Age Cohort 35

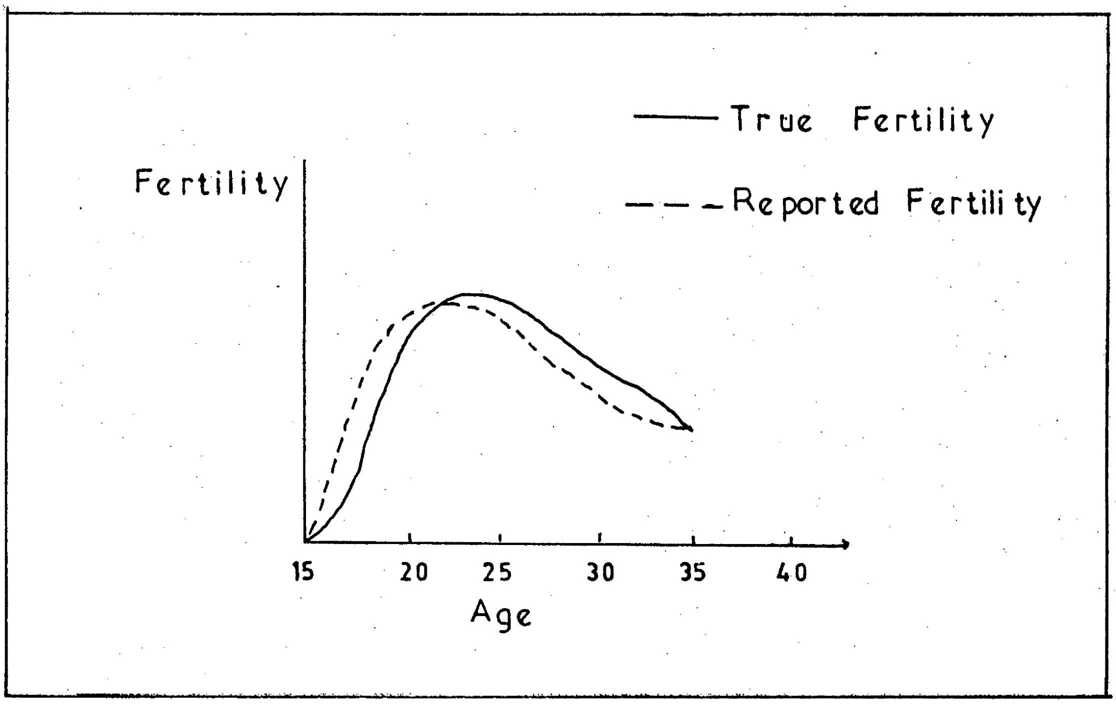
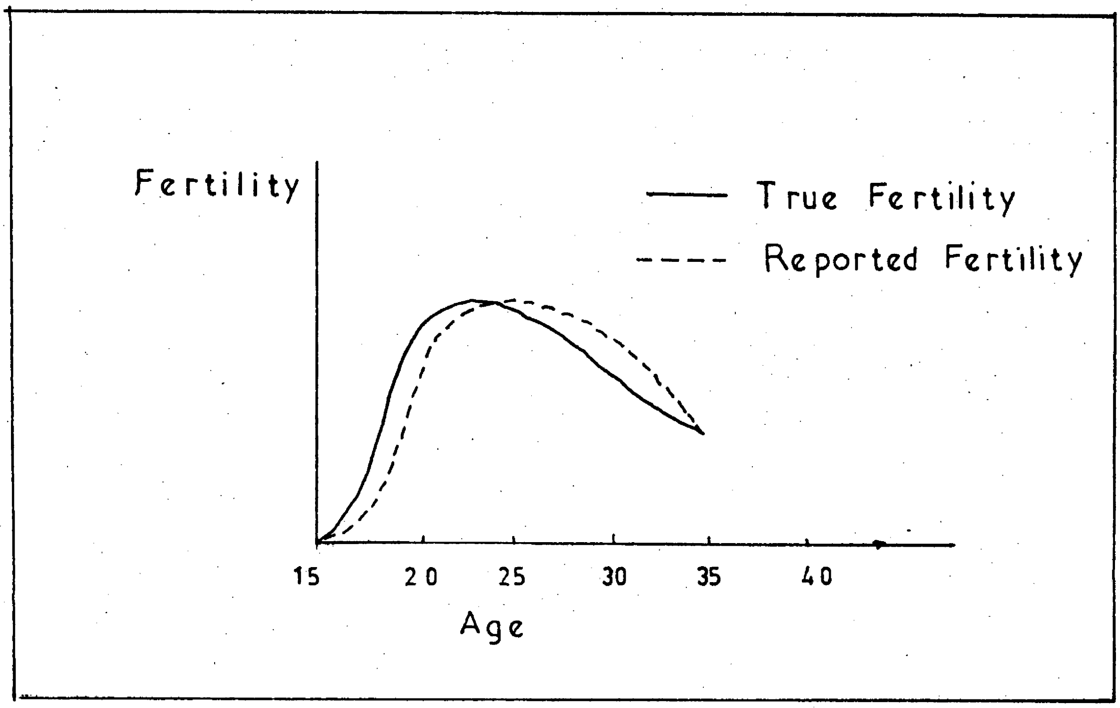


Figure 2.4

Older Reported Distribution of Fertility of Age Cohort 35



Source: Potter (1977a). Pps 338 and 339

order births used to correct observed fertility rates are unreasonable. Mis-statements do not occur in any systematic pattern as the Bogues' correction procedures imply. Neither are the reporting and distribution of errors in first order births the same for all order births as assumed by Brass. "...the difference between the distortions for the first births and all births implies that the correction scheme proposed by Brass is inapplicable. The 'timing errors' are not the same for first births as for births of all orders." (Potter 1977a:347). Potter simulated for misplacement of date of birth of children only. But he concedes that under-reporting and age mis-statement of mothers may interact with date of birth displacement to distort fertility schedules. This aspect of the method is discussed further in the study.

One way of reducing the ill-effects of age mis-statement among mothers is to calculate fertility rates by duration of marriage instead of by chronological age. Evidence from Fiji (1976:15), however, indicates that the duration of marriage data may not necessarily give better results. Although people were more willing to report date of marriage than date of birth in Fiji, reported marriage dates were slightly less consistent than age dates. In Africa where people are not particularly conscious of dates or where early marriage is practised, the use of age at marriage may present other problems. In the study area some people reported marrying as low as at age 6.

Similarly, reported deaths of children may suffer from omissions, age mis-statement and event misplacement. These errors may result in the reporting of death rates for an 'earlier' or a 'later' period than they actually occurred. Brass does not offer any suggestions for the correction of reported childhood mortality rates. Bogue and Bogue (1970:152-154) suggest only the inflation of the observed infant mortality rates by 25 and

50 per cent to get the 'medium' and 'high' estimates respectively. The scheme thus corrects for only under-reporting and leaves event misplacement and age mis-reporting errors untouched. Potter (1977a:352) on the other hand, suggests that the probabilities of dying to exact ages 2 [q(2)] and 5 [q(5)] should be calculated to reduce the potential influence of mis-reporting of date of death. Furthermore, childhood mortality should be calculated separately for both sexes, not only as a means for finding out sex differentials in mortality, but also for evaluating the data.

2.3 SOURCE AND EVALUATION OF DATA.

The pregnancy history method is normally used on the assumption that (a) the population under study will remember all pregnancies; (b) age-mis-statement among mothers is minimal or non-existent; and (c) dates of birth of children are not misplaced. The question is: can such ideal conditions be found with the data from the area under study? This section examines the above question and explores ways of making the data useable, bearing the observed limitations in mind.

2.3.1 Source Of Data.

In April 1974 the Demographic Scheme of the Department of Sociology of the University of Cape Coast (Ghana), initiated a longitudinal demographic survey which was continuously carried out from 1974 to 1977. (See Section 1.3). The questionnaire on pregnancy history consisted of a series of questions on number of children born alive, number of children still living, number of children living outside the household, number of children adopted in or out, number of pregnancies that did not result in a live birth, for example, still births and spontaneous and induced abortions; and whether or not the woman was pregnant at the time of the interview. This last question was put in to facilitate the tracing of the outcomes of pregnancies in subsequent counts. The number of children born alive, dead, still living and pregnancy loss were recorded in sequential order starting from the earliest to the latest birth or loss. Month and year of birth and year of death, if applicable, were recorded for each pregnancy outcome. A maximum of 12 pregnancies were allowed for each woman on the questionnaire. Where a woman had more than 12 pregnancies, the last 12 were recorded. Only 14 out of the 6923 women reported 12 pregnancies or more. The last question on the form, number eight, was posed if the interval between two adjacent births was two years or more in order to find out if some pregnancies had been omitted. (See Appendix A1). One major drawback of the questionnaire is that it did not include month of death, information needed for infant mortality studies.

The information from the pregnancy history was coded on 2 cards - cards 5 and 6 in the total survey data. The first eleven columns of both cards contained the household identification number and line number of the mother. Columns 12-15 were for the total number of children ever-born by sex. Number of children adopted into the household appeared in column 16. In columns 17 and 18-19 were the pregnancy status of the mother and total number of pregnancies respectively. Card number appeared in column 20. Columns 21-80 contained information on pregnancy outcomes with 10 columns for each pregnancy. Information on each child included pregnancy number, status of child, month and year of birth or pregnancy loss, sex of child, and year of death if applicable. In all 6,923 women were covered in the survey. Women under 55 years of age, 6206 of them, were selected for the study. Ten of these women had to be deleted because the year of birth of one or more of their were not reported. The rest reported 15,154 births.

Unless otherwise stated, this pregnancy history information is the source for fertility and mortality analysis in this study.

2.3.2 Evaluation Of Data.

Of the reported 15,154 pregnancy outcomes, 292 were still births or abortions, both spontaneous and induced. This number is very low and, therefore, makes one suspect under-reporting of still-births. The years of death of 15 births were recorded as being earlier than the years of birth. The mothers of those children with all their births were deleted. In a further 273 cases, (from 164 women), and which constituted nearly 2 per cent of all reported births, the difference between the ages of the children and that of their mothers was less than thirteen. That is, some of the women gave birth at unusually low ages. Table 2.2 shows the distribution of age of mother by the reported age at which these women gave birth. Sixteen of these children were born earlier than or at the same time as their mothers. This points to the tendency among women in Ghana to understate their ages and therefore report 'younger' fertility schedules. It must be pointed out that the same conclusion can be arrived at if the dates of birth of the children are reported earlier than they actually occurred.

Two alternatives came up as to how the 164 females should be treated. The first was to 'correct' the ages of the women using age at first marriage and date of birth of first child. It was assumed that women in the area gave birth to their first children within marriage and within the first year of marriage, and the reported age at first marriage was correct. Under these assumptions the 'correct' age of the mothers was calculated by adding the age at first marriage to the age of the first child at the time of the survey. The reported and the 'corrected' ages are given in Table 2.3. Fifty-eight per cent of these women with unusually low age at child-bearing

Table 2.2

Percentage Distribution of Children by the Reported and Derived Ages of Mother at Time of Birth

Reported Age of Women	Derived Age of Mother at Birth (In Years) <1-1	2-5	6-7	8-10	11-12	Total
	Number of Children					
15-19	0.0	4.2	4.0	1.2	4.0	2.9
20-24	0.0	12.5	4.0	7.2	11.2	8.8
25-29	6.3	4.2	12.0	16.9	8.8	11.0
30-34	12.5	8.3	16.0	21.7	18.4	17.9
35-39	25.0	0.0	12.0	7.2	15.2	11.7
40-44	18.7	25.0	32.0	19.3	18.4	20.5
45-49	12.5	12.5	8.0	12.0	12.8	12.2
50-54	25.0	33.3	12.0	14.5	11.2	15.0
Total	100.0	100.0	100.0	100.0	100.0	100.0
Number	16	24	25	83	125	273

Source: Pregnancy History Data, 1974. Cape Coast Project.

Table 2.3

Reported and Corrected Age Distribution of Females With Age at Birth Less than 13 Years Old, Study Area, 1974 (In Percentages)

	Age Distribution	
	Reported	Corrected
Age of Female	Per cent	Per cent
15-19	2	0
20-24	9	0
25-29	13	4
30-34	18	13
35-39	14	14
40-44	19	17
45-49	13	16
50-54	11	15
55-59	*	10
60+	0	11
Total	100	100
Number	164	164

* Less than 1 Per cent.

Source: Pregnancy History Data, 1974. Cape Coast Project.

reported their ages as being under 40; but when 'corrected' only 31 per cent were under 40.

The second alternative was to delete these women from the analysis. There was no basis to assume that the reported age of first births and age at marriage were correct. All things being equal, the ages of the first children and the ages at first marriage have the potential of being distorted. Without knowing the source and direction of the errors the correction procedure adopted above will either distort the results further or not improve the quality of the data in any way. Given the experience in other areas of Ghana (discussed below) one can speculate that all these women in the area have the potential to distort their ages and the dates of birth of their children; and therefore to be consistent all the ages of women should be corrected using the above procedure. This was not done because it was felt that the procedure would not improve the over-all quality of the data.

The 164 females were deleted for four reasons.

1. Age at first marriage was found to be unreliable. Sixty-five per cent of the ever-married women reported marrying between ages 15 and 18, both inclusive, and nearly one per cent (0.7) did not report age at first marriage. The ages of such women had to be estimated using an assumed age at first marriage. Eighteen, the modal age at first marriage, was used.

2. There is no basis for assuming that the rest of the women reported their ages correctly. These other women may have escaped scrutiny merely because none of their children's ages conflicted with theirs. To be consistent meant correcting the ages for all 6206 females.

3. When corrected for under-reporting, the ages of some of the women went beyond the 55 upper limit. (Col 3 Table 2.3). But for reasons given elsewhere, the analysis of the data was restricted to women below 55. These women above 55 after correction would then be deleted anyway.

4. The adjustment procedure assumes that the ages of children are correctly stated; an assumption which is difficult to accept. If the ages of chidren are over-stated, which may be likely, the same distortions can occur. There was, therefore, not much justification for using the procedure.

The above reasons, especially the second and fourth, are reinforced by evidence from some other studies about Ghana and the analysis of the age structure of the reported population of the area. In a study to trace the ages of children born in the compulsory vital registration areas, it was observed that age mis-statement was high and mostly to the next higher age. "Of the 608 age statements, 215 or 35 per cent were incorrect... Of the 215 cases of mis-statement 62 per cent were to the age group next above, 21 per cent to that next below..." (Caldwell 1966:485). Furthermore, "that the distribution of incorrect age statement does not form a completely balanced pattern is evident." (Caldwell 1966:486). Digital preference was given as one of the major reasons for the mis-statement. A quality-check reinterview survey after the 1960 Ghana census also revealed that as high as 44 per cent of the female population were recorded in different five-year categories in both the census and the survey. The proportion was 76 per cent for women 45 years and above (Seltzer,1973:12-15). Teenage girls were found to over-state their ages while older women under-state theirs. Hence there is an observed pattern of over-concentration of women in the reproductive age groups. For example, sex ratios from the 1960 census ranged from 83.1 to 98.6 per 100 females in the 24-34 age group when the national ratio was 102.2 (Gaisie 1976:18).

The features of the 1960 Census population appear in the 1970 Census and 1974-7 Survey populations as well. The percentage distribution of the populations from the 1960 and 1970 Censuses and the 1974 Survey in broad age groups come close to one another. Indices of age- and sex-reporting accuracy from Whipple's, Myers' and United Nations Secretariat Methods (Appendix B1) also show similar distortions with age data from the three sources. Whipple's Index obtained for the female populations of 1960, 1970 and 1974, for example, put all three data in the category of "very rough data" (175 points or more). The percentage distribution of blended sums for each digit from Myer's Index also show similar distortions among the survey population, the total Ghana population, and those in rural, urban and Western Ghana populations (Appendix B2). The observed preference for 0, 5, 8 and 2, in that order of magnitude, in the census population are duplicated in the survey results.

For sex ratios among broad age groups the ratios of the Cape Coast Project population differ from those of total Ghana (Appendix B3). The reported total sex ratio of 95 per 100 females for the survey area , and the very low ratios among the 15-64 and especially the 45-64 women may be the result of either heavy male out-migration or favourable female reporting or both. But this does not negate the fact that the reported ages are unreliable.

Evidence deduced so far indicates that the characteristics and distortions of the reported 1974 population of the survey area are similar to those of the 1960 and 1970 census populations of total Ghana, rural and Western Ghana. It may then be inferred that the age mis-statement observed among Ghanaian populations by Caldwell (1966) and Seltzer (1973:12-15) do apply to the survey area and the discrepancies reflect the age mis-statement and event misplacements in the data. Therefore, the basic assumption of correct age statement among children could not be upheld for the procedure to be used.

2.3.3 Setting Out The Data For Study.

The computer programme that edited the data for inconsistencies was part of a major programme for tabulating the pregnancy history data for fertility studies. The programme tabulated the number of births by age of mother and by years before the survey as well as tabulating the person years lived by the female population at each age since 1931. Copies of the results given in Appendices A3 - A5, formed the basis for all the fertility estimates. A new programme had to be written because the data were not collected and set out in a form that would enable one to use the Bogues' programmes. (Bogue and Bogue 1970 Chapter 5.)

At this point a note on the calculation of person years lived is necessary. In the survey, age of mother was collected in completed years rather than in year and month of birth. As a result a process was developed to allocate a female to her year of birth and based on this result her age at birth of child was calculated.

The process adopted was

YB = [[(SYx12+SM)-(AOWx12)]/12] - 1

where YB = Year of birth

SY = Year of Survey, 1974 in this case.

SM = Month of Survey, in this case 4 i.e. April

AOW = Age of woman.

Since the survey month (SM) was four (4-April), it follows that the survey year covers the period beginning from May to the end of April of the following year. Thus 1973, refers to the period from May 1973 to April 1974.

Fractions were rejected. The derived number of women in 1973 corresponded with those obtained in the 1974 survey for each age (Jain 1978:36 and 37). Age of child, in completed years, was obtained by subtracting year and month of birth from the year and month of survey. This age was subtracted from the reported age of mother to get the age at birth.

The problem was with children with month of birth not reported. These children constituted 3 per cent of the total children. Ideally the allocation of months to these births should have been pro-rated according to the distribution of births by month. This was not done because this distribution was found to be biased towards the first four months of the year. This was due to the fact that the survey was conducted in April and therefore January to April were chosen by both respondents and interviewers as convenient months. The Bogues (1970:53) have suggested that events with month of birth not reported should be coded 7, that is July. The Bogues' suggestion was not used because the reported months of birth were not good enough for such a procedure to be used. The births (with month not reported) were therefore sequentially allocated January through December as they were encountered.

As pointed out earlier the reported pregnancy outcomes of women aged 55 and below but above 13 at the time of the survey were used. These age limits were used for two reasons. Firstly, it is believed that younger women are more likely to remember events and report them correctly than older ones; and given the observed high age misreporting among Ghanaian women in the older ages it was felt that 55 was a fair upper limit. Secondly, the upper limit was set at 55 so that the greatest part of all current and past reproductive ages would be covered after allowing for overstatement of age.

The mortality data, on the other hand, was based on the number of children dying before age 5 among those born after 1950, and whose mothers were aged between 13 and 55 at the time of the survey. The births and deaths before 1950 were excluded because the reported deaths per year were very small. In all, there were 12,428 births with a sex ratio at birth of 99.5 (males per 100 females). Using an SPSS programme the data was cross-tabulated according to year of birth by year of death separately for the two sexes. The results are shown in Tables 2.4a and b. This procedure was adopted in order to overcome problems posed by the non-availability of month of death information in the questionnaire. With month of death not included it was not possible to use Bogue's programme which necessitated provision of both month and year of death.

Also, it was impossible without the month of death information, to calculate age at death of children without adjusting the basic data to identify those who died in the following year but before their first birthday. It is the same with children who died in the second year but before their second birthday. A procedure was adopted to split the children who died in the following year into those aged 0 and 1; and those who died

Table 2.4a

Males - Year of Birth by Year of Death Since

1950. Study Area

Year of Death																									Total	Total
50	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	Deaths	Births
1	4	3	2	2	1	0	0	0	1	2	1	0	0	0	0	0	0	0	0	3	0	0	0	0	40	147
	10	2	3	2	0	0	1	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	21	106
		12	2	2	0	0	0	1	1	3	0	0	0	0	0	0	2	1	0	0	2	0	0	1	27	130
			14	7	1	0	3	0	0	1	1	0	1	0	0	0	0	1	0	0	0	0	0	0	29	132
				17	5	3	2	0	1	0	0	2	0	2	0	0	0	1	0	1	0	0	0	0	34	168
					10	3	3	2	0	3	0	1	0	0	2	0	1	0	0	1	0	0	0	0	26	151
						9	2	3	2	2	0	2	1	0	0	0	1	1	0	2	0	0	0	0	25	212
							12	6	4	6	0	0	0	0	0	0	0	0	0	0	0	0	1	1	30	210
								15	9	10	2	1	2	2	1	2	0	0	0	1	1	0	0	1	47	245
									20	6	7	6	1	2	4	1	0	0	1	0	0	0	0	0	48	258
										14	9	5	4	2	4	1	1	2	1	1	0	1	0	0	45	261
											20	7	5	3	1	1	1	1	3	1	0	1	0	2	46	232
												13	4	6	2	4	0	3	1	3	1	1	0	0	38	293
													21	6	7	1	3	1	1	3	0	1	1	0	45	264
														15	16	6	4	2	2	1	1	2	1	2	52	342
															20	8	6	1	0	2	0	2	2	0	41	314
																29	13	6	2	4	0	2	1	1	58	350
																	19	9	6	4	1	1	1	0	41	341
																		21	14	9	4	4	3	0	55	405
																			21	13	8	7	4	1	54	386
																				34	14	8	7	0	63	409
																					20	16	6	6	48	435
																						27	19	1	47	409
																							26	8	34	424
																								7	7	152
																									1001	6776

Pregnancy History Data, 1974. Cape Coast Project.

Table 2.4b

Females - Year of Birth by Year of Death Since

1950. Study Area

ır f th	Year of Death																									Total	Total
	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	Deaths	Births
)	8	3	1	1	0	1	0	0	1	0	0	1	0	0	0	0	1	0	1	0	1	1	1	1	0	22	129
l		9	0	1	1	2	1	1	1	1	1	0	1	0	0	0	0	0	0	0	1	0	1	0	0	21	110
2			7	1	5	3	1	0	0	1	0	1	1	0	0	1	1	1	1	0	1	1	0	0	0	26	156
3				10	4	3	2	0	0	0	1	0	0	0	1	0	1	1	1	0	1	0	0	0	0	25	133
4					9	3	1	2	1	3	0	0	0	0	2	1	0	0	0	1	2	1	0	1	0	27	191
5						12	3	1	1	1	0	0	0	0	0	2	0	1	0	0	0	0	1	0	0	22	164
6							11	3	3	3	3	1	1	0	0	0	1	1	1	0	0	0	0	0	0	28	232
7								10	6	6	3	0	0	1	0	0	1	0	0	0	0	0	0	0	0	27	229
8									14	7	4	0	0	1	1	0	0	0	3	1	2	0	1	1	0	35	224
9										22	9	5	3	3	0	1	3	1	0	0	1	2	0	0	0	50	247
0											8	5	11	3	3	2	1	1	0	0	1	1	0	0	0	36	237
1												18	3	2	2	1	0	0	1	0	0	1	0	1	0	29	259
2													12	12	6	1	2	4	2	1	0	2	3	0	0	45	288
3														17	4	6	5	1	2	0	0	3	2	0	0	40	291
4															26	14	7	1	1	3	3	3	0	1	0	59	355
5																21	5	3	5	1	2	2	2	1	0	42	328
6																	22	7	12	4	2	1	1	1	0	50	350
7																		15	6	2	3	6	2	3	0	37	323
8																			17	4	5	4	2	2	2	36	359
																				19	14	16	2	3	2	56	392
																					20	10	14	10	2	56	414
																						16	14	10	2	42	387
																							21	23	7	51	430
																								19	3	22	426
																									6	6	142
l																										890	6796

ce: Pregnancy History Data, 1974. Cape Coast Project.

in the second year into those aged 1 and 2. The procedure adopted is discussed in Appendix C.

Potter (1977a:352) on the other hand has suggested that (q(2)) and q(5)), should be calculated in preference to infant mortality in order to overcome the problem of age-heaping at age 1. More than any single mortality measure, the level of infant mortality provides a fairly adequate knowledge about the nature of medical care and health conditions in an area. Thus infant mortality is of special interest in mortality studies, especially in developing countries and particularly in Africa, where most deaths occur in the first few years of life (Cantrelle 1975:102). So although Potter's (1977a:352) suggestion is reasonable it is felt to be necessary to compute infant mortality in addition to other mortality estimates.

2.3.4 Conclusion.

There is no doubt that the Pregnancy History Method provides enough information for mortality and fertility studies. Available evidence however indicates that data from the method is fraught with a number of problems. Some of these problems have been observed in other demographic surveys in Ghana while some are assosciated specifically with pregnancy history information from developing countries.

Cases of mothers giving birth before age 10 found in the data point to possible event misplacement and age mis-statement errors assosciated with pregnancy history data. These misplacements may be the result of either women reporting 'younger' ages, children's date of birth being reported further away from period of survey or both. In most cases it is difficult to tell which of these two occurrences are responsible for the misplacements. The observed discrepancies between date of birth and date of death might have possibly occurred at the recording or punching stages and escaped editing. The women who gave birth at unusually low ages and the events with discrepancies between dates of birth and death had to be deleted for various reasons. In addition various methods were employed to get the necessary information for fertility and mortality studies because the data set-up from the survey did not allow the use Bogue's programme developed for pregnancy history analysis.

The methods used to get the necessary information for analysis do not imply that the data were fully devoid of all errors. At best, the methods made it possible to delete obvious errors and put some confidence in the data used.

CHAPTER 3

OBSERVED FERTILITY AND CHILDHOOD MORTALITY

3.1 INTRODUCTION

Available evidence indicates that Tropical Africa is one of the major World regions with a high level of fertility and mortality; and Ghana is no exception. The crude birth rate for Ghana has been estimated to vary between 47 and 55 per thousand population during 1945 to 1969. In 1971, the crude birth rate was estimated as 49.6 from the 1971 Supplementary Inquiry. The recorded crude birth rate ranged from 47 in 1959/60 and 1968/9 to 42 per thousand population in 1971. Also, women in Ghana have about 6 or more children at the end of their reproductive period. The mean number of children ever-born from the 1948 Census, the 1960 Post Enumeration Survey and the 1968/9 National Demographic Sample Survey were 6.6, 6.4 and 6.0 respectively. Recorded and estimated total fertility rates from 1957 to 1971 were 5.8-6.9 and 6.5-7.3 respectively (Gaisie and de Graft-Johnson 1976:12). Gross and net reproduction rates are also high. Estimated gross and net reproduction rates were 3.2-3.5 and 2-2.4 respectively in 1968/9 (Gaisie and de Graft-Johnson 1976:13). These rates do not vary much from the estimated average from 1948 to 1960 being 3.6 for gross and 2.2 for net reproduction rates.These rates are in most cases about twice the average observed in the developed countries. (Table 3.1).

Table 3.1

Summary of Vital Rates for Ghana: 1948-71

Measure	Year 1948 [a]	1960 [b]	1968/9 [b]	1971 [b]
Crude Birth Rate ('000)	52	52	49.5	49.6
Total Fertility Rate	7.2	6.9	6.8	6.9
Gross Reproduction Rate	← 3.6 →		3.2-3.5	NA
Net Reproduction Rate	← 2.2 →		2.0-2.4	NA
Crude Death Rate	24	21	19-20	18
Infant Mortality - Male	NA	NA	145	122
- Female	NA	NA	121	
Expectation of Life At Birth - Male	39.5	45.5	45.6	44.0
- Female			48.3	47.3

NA = Not Available

Sources: (a)Caldwell (1967), Tables 2.8 and 2.14

(b)Gaisie and de Graft-Johnson (1976), Tables 2.1 and 2.11.

Mortality is also high in Ghana. The crude death rate in the country has been estimated as 24 per thousand population in 1948, 21 in 1960 and 20 in 1968/9. One of the major contributors to this high level of mortality is infant deaths. In 1968/9, the infant mortality rate was estimated to be 133 and 148 deaths per thousand live-births for total and rural Ghana respectively. This high level of mortality obviously leads to low expectations of life at birth. Based on censuses and surveys, the expectation of life at birth for the country has been estimated as 39.5, 45.5 and 46.9 years for 1948, 1960 and 1968/9 respectively. These figures vary according to sex. In 1968/9 the expectation of life at birth was 48.3 years for females as compared with 45.6 years for males (Gaisie and de Graft-Johnson 1976:21).

3.2 FERTILITY

Conventionally, fertility information from censuses and surveys has been based on two questions: the number of children ever-born to a woman and births during a given reference period, usually over twelve months before the date of the inquiry. The former provides data for computing past fertility performance (Parity) while the latter is concerned with 'current' cross-sectional fertility estimates. Where fertility has been observed to remain constant over the recent past, the sum of the age-specific fertility rates of all women in the reproductive ages comes close to the parity of women past child-bearing age (United Nations 1967:72-74). It must be pointed out that the same completed family size can be achieved with different patterns (timing of births) of fertility.

Over the past three decades completed family size in Ghana is believed to have remained constant. The average number of children ever-born to women 50 years and over, has been reported as 6.6, 6.4 and 6.0 for 1948, 1960 and 1968 respectively (Gaisie 1976:85). According to results from surveys and censuses, fertility has also varied by region, urban-rural residence, ethnicity, etc. The reported total fertility rate for Western Ghana, for example, has been estimated as 6.6 in 1960 and 5.9 in 1968 as compared with 6.0 and 4.9 for Greater Accra in the same periods. (Gaisie 1976:83; Page 1975:43). The observed or estimated rural fertility exceeds urban fertility by about 10 per cent or more, though the proportion depends on other socio-economic variables. In terms of ethnic background, the <u>Akans</u> have been found to have the highest total fertility and completed family size (Gaisie 1972:87), although this is not true for all <u>Akan</u> groups. It is, however, difficult to put much confidence in these rates since demographic data from Ghana is subject to a number of errors.

Presented in this section are the data on cohort and cross-sectional fertility from pregnancy history data from the Western Region survey. The objectives here are to find out, firstly, the levels, trends and patterns of fertility in the area over the last 40 years before the survey and secondly, to evaluate whether or not the pregnancy history data have been sufficiently well reported. The fertility rates presented are parity distributions, children ever-born, completed family size, age-specific and total fertility rates. These rates are compared with the results from the registration system from the study area, and rates for Ghana and some selected African countries.

3.2.1 Mean Children Ever-born

Information on the mean number of children are derived from past fertility performance. The mean number of children ever-born by age to women aged from 15-19 to 55-59 in the survey area are shown in Table 3.2. Data of this nature are subject to omissions from memory decay, age

Table 3.2

Mean Number of Children Ever-born to all Females Aged 15-19 t0 55-59, Study Area. 1974

Age of Female	Mean Number of Children Ever-born	No.
15-19	0.26	1182
20-24	1.35	993
25-29	2.68	860
30-34	4.19	632
35-39	4.79	601
40-44	5.08	454
45-49	5.21	393
50-54	5.08	312
55-59	5.73	193

Source: Pregnancy History Data, 1974. Cape Coast Project.

mis-statement and failure to report births of children who died immediately after birth as live-born children (Gaisie 1976:78). The rise and fall in the mean number of children ever-born to women aged between 45-49 and 55-59 may be the outcome of the first two errors rather than any change in fertility among the various age cohorts.

On the whole the mean number of children ever-born to women 50 years and over is lower in the study area than what has been observed in all of Ghana, and among the Akans in particular. Completed family size among the Akans has been estimated as 6.6 (Gaisie 1972:86). So also is the completed family size of the Wassaws, the major ethnic group in the area. Under-reporting may, therefore, partly account for the 'low' fertility observed in the area.

In spite of the above errors one feature stands out clearly; and that is, that the area has relatively high fertility. This is not surprising for an Akan area. For the Akans encourage high fertility and public ceremonies are performed for women who have given birth to ten children. Conversely, childless women are looked upon with pity and contempt because they could not contribute to the continuity of the lineage which is through the female.

3.2.2 Parity Distribution

Summary measures like mean number of children ever-born to women at a given age conceal the variations in the distribution of births. A frequency distribution of births, therefore, helps to overcome this problem. In Table 3.3, the frequency distribution of births among women aged 40-54 for the survey population in 1974 and 1975 and among women aged 45-49 for Ghana and the Western Region for 1960 are given.

Table 3.3

Parity Distribution among women 40-54: Study area, Rural Western and Total Ghana. 1960 and 1974-5. (percentages)

Age of female	Number of Children						
1974 (a)	0	1	2-4	5-7	8+	Total	No.
40-44	11.5	5.5	25.7	28.9	28.4	100.0	454
45-49	7.6	7.9	28.2	31.3	24.9	100.0	393
50-54	5.4	9.9	29.5	31.7	23.3	100.0	312
1975 Survey (b)							
40-44	8.2	6.2	23.2	30.4	32.0	100.0	484
45-49	7.5	4.2	25.2	32.0	31.1	100.0	388
50-54	9.9	6.5	22.5	29.5	31.6	100.0	373
Ghana - 1960 (c)							
45-49	4.6	5.8	23.5	33.7	32.4	100.0	94640
Rural Ghana - 1960 (c)							
45-49	3.9	5.1	22.3	34.0	34.8	100.0	74240
Rural Western Ghana - 1960 (c)							
45-49	2.5	3.5	21.5	32.8	39.7	100.0	14180

Sources: (a) Jain S.K. (1978(a)) p 107
(b) Jain S.K. (1978(b)) p 107
(c) Gil et al 1971 p 277

In broad terms about 60 per cent of the survey population have 5 or more children at the end of their reproductive period. But 70 per cent of the 1960 Ghana and rural Western Region female populations have 5 or more children by age 50. One other major difference between the parity distribution of the survey population and that of total Ghana or rural Western Region is the proportion of childless women among the 45-49 age group. In a society where childlessness is a stigma (Gaisie 1976:52), the proportion of nulliparous women gives some indication of the level of primary infertility. The data show that the area has more women in the older ages without children than the total country. The high proportion of women in the survey area can, however, be due to the omissions of children who have left home, childlessness or both. One common feature of both the survey area and the 1960 Post Enumeration Survey of Ghana data (Table 3.3) is the near equal proportion of women with only one child--6 per cent in most cases. This is an indication of secondary sterility among a high proportion of the Ghanaian population, an observation which has not been fully investigated. This high level of primary and secondary sterility may partly account for the 'low' completed family size in the area. It should be pointed out that the differences between the distributions of the 1974 and 1975 data on one hand and that of the 1960 Post Enumeration Survey on the other may be due to differences in the sizes, comparability and representativeness of the survey populations. The level of childlessness in the area is, however, nowhere near those of some districts in Zaire where nearly 40 per cent of the women go through their reproductive years without having children (Page 1975:33).

3.2.3 Trends And Levels In Fertility

Age-specific fertility rates for single years for 15 years before the survey are presented in Table 3.4. The rates fluctuate so widely from year to year that it is difficult to establish any trends. Among the 15-19 age group, for example, the fertility rates range from .1555 in 1962 to .0932 in 1973. The maximum and the minimum rates are separated by a number of fluctuating rates. Secondly, the rates for the last three years preceding the survey give an impression of a decrease followed by an increase in fertility, an improbable situation. And thirdly, the rates for the years ending with 5 and even numbers are higher than the rest.

The rates indicate that fertility is high, starts at an early age and continues into the older ages. The early age at child-bearing reflects the early age at marriage. Although it is difficult to establish its accuracy, the data on age at first marriage reveal that women in the area marry very early. Ninety per cent of the married women in the survey were married before age 21 with a mean age of first marriage of 17.9 years. This conforms to what has been observed elsewhere in Ghana especially among the Akans, where the estimated singulate mean age at first marriage from the 1960 Post Enumeration Survey is 17.7 years (Gaisie 1976:37). The persistent high fertility among women aged 40 years and over may be due to age mis-statement rather than to any real situation because child-bearing at old ages is something frowned upon in Akan societies.

The total fertility rates for women aged 15-44 based on the above age-specific fertility rates similarly fluctuate from year to year (Table 3.4), ranging form 4.7 in 1972 to 6.4 in 1963. The dip in the 13-24 months before the survey has been a feature associated with pregnancy history data which has errors of age mis-statement and event misplacement (see, for example, McDonald et al 1976:12-13). The peaks in the rates coincide with

Table 3.4

Age-Specific and Total Fertility Rates for 15 years before Survey: 1959-1973
The Study Area.

Year	Total Women	Total Births	Age of Women 15-19	20-24	25-29	30-34	35-39	40-44	45-49	Total Fertility Rate 15-44
1959	2,799	504	.151	.279	.234	.233	.143	.118	*	5.7
1960	2,964	486	.138	.216	.233	.205	.164	.149	*	5.5
1961	3,187	519	.116	.262	.229	.250	.123	.123	*	5.5
1962	3,378	534	.156	.194	.262	.179	.175	.081	*	5.2
1963	3,517	670	.137	.304	.282	.274	.192	.090	*	6.4
1964	3,712	625	.110	.270	.245	.222	.206	.087	.158	5.7
1965	3,878	676	.115	.293	.230	.284	.163	.105	.061	6.0
1966	4,136	682	.133	.270	.274	.183	.168	.094	.061	5.6
1967	4,329	689	.111	.250	.250	.256	.155	.096	.024	5.6
1968	4,601	779	.127	.269	.252	.244	.225	.119	.030	6.2
1969	4,824	787	.118	.250	.275	.220	.225	.094	.050	5.9
1970	5,052	767	.143	.222	.269	.190	.172	.098	.034	5.5
1971	5,284	823	.131	.250	.265	.213	.155	.110	.047	5.6
1972	5,525	719	.116	.216	.220	.168	.137	.076	.026	4.7
1973	5,764	818	.093	.234	.234	.233	.186	.082	.038	5.3

* Not available
N.B. Year refers to the period of May to April the following year.

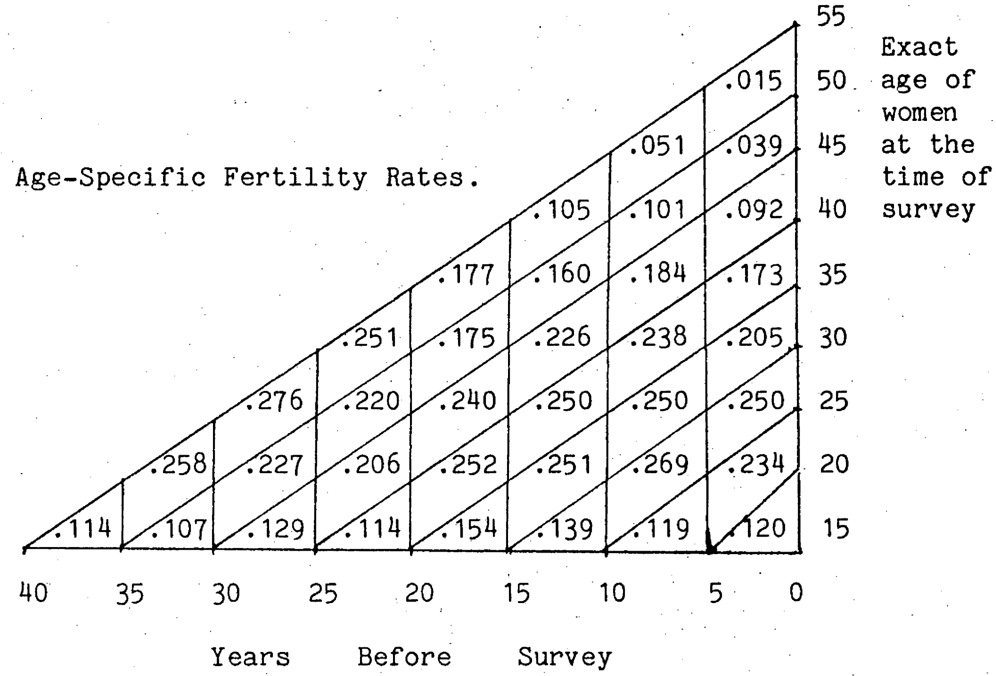
Source: Pregnancy History Data, 1974. Cape Coast Project.

the periods which are multiples of 5 years before the survey; and the low rate of 4.7 may not be unrelated to digital preference. Estimates for Ghana indicate that total fertility has remained fairly constant between 6 and 7 for the past three decades (Gaisie 1976:85). Except for 1963 none of the observed rates comes close to the Ghanaian average. Nevertheless the Wassaws, the major ethnic group in the area, have been found to report one of the 'lowest' total fertility rates among the Akans, the ethnic group which accounts for most of the high fertility in Ghana. Gaisie (1972:86) classifies the total fertility rate of 5.3 for the Wassaws, among the 'moderate' fertility groups of Ghana such as the Akuapims, Guans and the Nzimas. This low rate among the Wassaws is attributed to the use of contraceptives and the resort to abortions when pregnant. One of the major failures of the Family Planning Programme in Ghana is its inability to penetrate into the rural areas where they are mostly needed (Engmann 1972:134). It is therefore very doubtful if the low fertility rates in a completely rural environment can be attributed to the use of contraceptives. The high incidence of primary and secondary sterility may partly explain the low fertility in the area.

The age-specific fertility rates in 5-year periods for 40 years before the survey for women 15-44 years old are shown in Table 3.5. The table gives both cross-sectional and birth-cohort fertility rates. The latter is obtained from the diagonals of the table and these are women who were aged between 40 and 54 at the time of the survey. The table also enables one to analyse fertility rates for the same age group over a time period. For example, the fertility of women aged 30-34 has varied from .2509 in 20-24 to .2048 in 0-4 years before the survey. In areas where age or event mis-statement is non-existent, these differences are said to show changes in fertility. But this cannot be said of the data from the study area. The data show that age-specific fertility rates of the cross-sectional

Table 3.5

Birth Cohort and Cross-Sectional Age-Specific and Total Fertility Rates. Study area in Western Ghana.



Total Fertility Rates for women aged 15-44 Years.

Cross - Section		Age Cohort	
Period	Total fertility (15-44)	Date of Birth	Total fertility (15-44)
1959-63	5.7	1919-23	5.9
1964-68	5.8	1924-28	4.9
1969-73	5.4	1929-33	5.3

Source: Pregnancy History Data, 1974. Cape Coast Project.

populations both increased and decreased over the last 15 years, with the period 5-9 years before the survey having the highest rates at all ages except among the 15-19 age group. For the birth cohorts, the 1919-23 group (see the first diagonal in Table 3.5) has the highest fertility at all ages except among the 15-19 and the 35-39 age groups. Worth noting are the exceptionally low rates among the 1924-28 (second diagonal) birth cohort. This might possibly be due to age shifting among mothers and/or event misplacement.

The women aged 15-44 in the cross-sectional data reported total fertility rates of 5.3, 5.8 and 5.7 in the 0-4, 5-9 and 10-14 years respectively before the survey. Completed family size among the birth cohorts are 5.9, 4.9 and 5.3 respectively for the 1919-23, 1924-28 and the 1929-33 birth cohorts. With the exception of the 1924-8 birth cohort, the total fertility rates and the completed family size from the pregnancy history data compare very well with the mean number of children ever-born to women 50 years and over, (Table 3.1) the total fertility rate from the registration system and the total fertility rate of the Wassaws. The rates are, however, below those observed for the Akan population or the rural areas of the Western Region. One variable likely to account for some of the variations in the levels of fertility between the survey area on one hand and total Ghana on the other is differences in marriage patterns. The available data, however, show that there is no difference in the age at first marriage and the proportion marrying by age 30 between the survey and Ghanaian populations (Jain 1978:43; Aryee and Gaisie 1979:10-11). The high incidence of primary and secondary infertility in the area is likely to lower the level of fertility.

3.2.4 Patterns Of Fertility

The patterns of fertility for both the single and 5-year rates together with that of the registration data and that of Ghana are given in Table 3.6. Age mis-statement and/or event misplacement which occur in the data are indicated by the discrepancies in the pattern of some of the periods. For example, in 1964, the proportion of fertility occurring to women aged 45-49 is higher than that of 40-44; and in 1967, the maximum proportion of births occurs among the 30-34 age group. Ignoring these abnormalities, it can be observed that the age schedule of fertility has a broad peak with the maximum occurring among either the 20-24 or 25-29 age group. In most cases the 25-29 age group has a slight edge over the 20-24 age group. The estimated age structure of fertility from the [Ghana] National Demographic Sample Survey (NDSS) has a similar broad peak although the maximum fertility occurs among the 20-24 age group (Gaisie 1976:97).

In Table 3.7 the patterns of the fertility schedules are converted into Pavlik (1971:37) and United Nations (1963) typologies of the relative share of fertility in different age groups. Pavlik "claims that the normal age fertility curve is characterised by the 'BCCA pattern' which frequently occurs in countries with little use of contraceptives and high total fertility rate." (Kpedekpo 1976:13). The United Nations model classifies fertility schedules into (1) early peak (maximum fertility in age group 20-24) (2) late peak (maximum fertility in age group 25-29) and (3) broad peak (age-specific rates in age groups 20-24 and 25-29 differ only slightly.

Four out of the ten single- year rates exhibit the pattern said to be characteristic of developing countries. The rest, like the cross-sectional data from the five-year averages follow Ghana's pattern, which in particular "...exhibit implausibly high fertility at older ages relative to that at

Table 3.6

Per cent of Total Fertility in Specified Age Groups. Study Area and Total Ghana.

Period	15-19	20-24	25-29	30-34	35-39	40-44	45-49	Total	Total Fertility 15-49
	Age of Women — Cross-Section — Per cent of Fertility								
1964 [a]	8.5	20.8	18.9	17.1	15.9	6.7	12.0	100.0	6.5
1965	9.2	23.4	18.4	22.7	13.0	8.4	4.9	100.0	6.3
1966	11.3	22.8	23.2	15.4	14.2	7.9	5.2	100.0	5.9
1967	9.7	21.9	21.9	22.4	13.6	8.4	2.1	100.0	5.7
1968	10.0	21.2	19.9	19.2	17.8	9.4	2.4	100.0	6.3
1969	9.6	20.3	22.3	17.9	18.2	7.6	4.1	100.0	6.2
1970	12.7	19.7	23.8	16.9	15.2	8.7	3.0	100.0	5.6
1971	11.2	21.4	22.6	18.2	13.2	9.4	4.0	100.0	5.8
1972	12.2	22.5	22.9	17.5	14.2	7.9	2.7	100.0	4.8
1973	8.5	21.3	21.3	21.1	16.9	7.5	3.4	100.0	5.5
1964-68	10.7	21.0	22.5	18.4	15.6	8.3	3.5	100.0	5.6
1969-73	9.8	22.2	20.7	19.6	15.2	8.3	4.2	100.0	6.1
	Birth Cohort								
1919-23	9.2	21.0	22.4	20.4	14.4	8.5	4.1	100.0	6.2
1924-28	10.5	22.1	21.5	17.0	15.6	9.8	3.8	100.0	5.1
	Registration [b]								
1974	14.2	24.1	21.8	18.9	14.2	5.4	1.4	100.0	5.8
	Ghana [c]								
1960	10.8	20.8	21.6	19.6	15.0	8.5	3.7	100.0	6.2

Sources: (a) Pregnancy History Data, 1974. Cape Coast.
(b) Jain (Forthcoming)
(c) Kpedekpo (1976), p 24.

Table 3.7

Classification of Types of Fertility Patterns According to the Proportion of Total Fertility Falling into Specified Age Groups by Pavlik's and U.N. Models

Pavlik's Model[b]

	Age of Women			
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

United Nations' Model[c]

EP	Early	Peak	(maximum fertility at age group 20-24)
LP	Late	Peak	(maximum fertility at age group 25-29)
BP	Broad	Peak	(age-specific fertility rates at ages 20-24 and 25-29 about equal)

Western Region of Ghana[a]

	Age of Women				Model	
	15-29	15-24	15-19	40-49	Pavlik	U.N.
Year		Cross-Section Data (Single Years)				
1964	48.2	29.3	8.5	18.7	ABBA	EP
1965	51.0	32.6	9.2	13.3	BCBA	EP
1966	57.3	34.1	11.3	13.1	BCCA	BP
1967	53.5	31.6	9.7	10.5	BCBA	BP
1968	51.1	31.2	10.0	11.8	BCBA	EP
1969	52.2	29.9	9.6	11.7	BBBA	BP
1970	56.2	32.4	12.7	11.7	BCCA	LP
1971	55.2	32.6	11.2	13.4	BCCA	BP
1972	57.6	34.7	12.2	10.6	BCCA	BP
1973	51.1	29.8	8.5	10.8	BBBA	BP
		Cross-Section Data (Grouped)				
1964-68	54.2	31.7	10.7	11.8	BCBA	BP
1969-73	52.7	32.0	9.8	12.5	BCBA	BP
		Birth Cohort (Grouped)				
1919-23	52.6	30.2	9.2	12.6	BBBA	BP
1924-28	54.1	32.6	10.5	13.6	BCBA	BP
		Registration Data				
1974-77	60.1	38.3	14.2	6.8	BCCC	EP
		Ghana[d]				
1960	53.2	31.6	10.8	12.2	BCBA	BP
		14 Francophone African Countries[e]				
1955-61	62.7	41.1	17.1	7.9	CDDB	EP

Sources: (a) Pregnancy History Data, 1974. Cape Coast Project.
(b) - (e) Kpedekpo (1976) p.12.

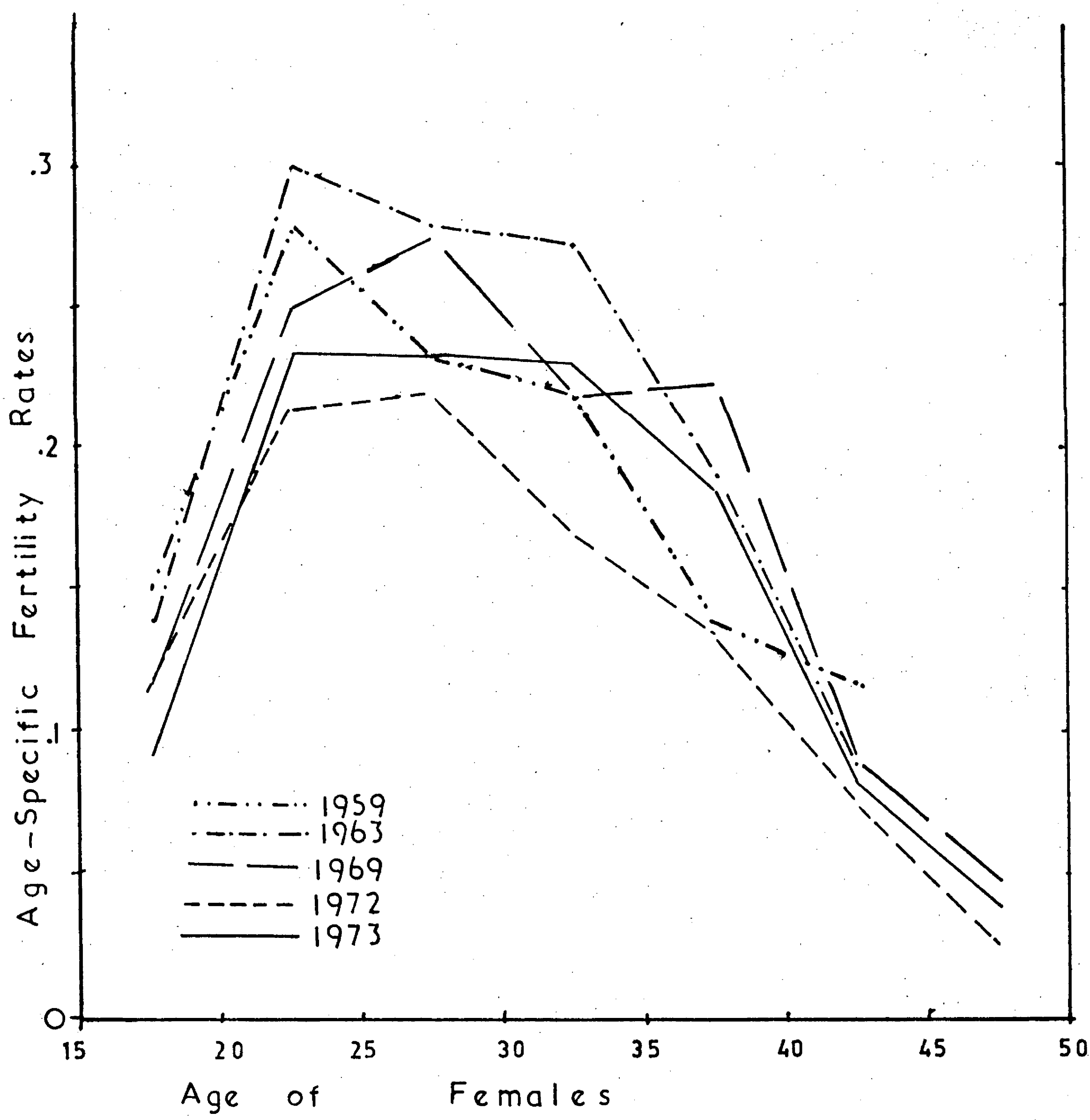
younger ages...." (Page 1975:34). The 1919-23 age cohort shows a different type, although not very much different from the BCCA type. The registration data depicts quite a different pattern altogether showing a relatively young distribution of the fertility schedule. The pregnancy history fertility schedules differ also from that of 14 Francophone African countries which have particularly high fertility at the younger ages. The difference between the fertility schedules of the pregnancy history data on one hand and the rest of the schedules presented in Table 3.7 on the other, can be due to sheer random variations in the data and the small number of reported events.

The variations in the fertility schedules for the study area from one period to the other cannot be explained only in terms of fertility change. Graphs for,the 5-year schedules reveal a tendency among older women to report 'older' fertility schedules (Figure 3.1). The low age-specific fertility rate in the 0-4 period among the 20-24 age group at the time of the survey may possibly be due to event misplacement and/or under-reporting of events. One can infer from the fertility rates of the 30-34 age group that some of their events have been mistakenly placed in the 5-9 years before the survey. It is , however, difficult to explain the dip at age 30-34 among the 1924-28 birth cohort. It can be partly due to under-reporting of events, the effects of mortality among that cohort, or both.

The reporting of 'older' fertility schedules is more marked in the single-year rates (Figure 3.2); and they are more distorted than those of the five-year rates. Furthermore, the rates for multiples of five-year periods before the survey have higher rates and are more distorted at the older ages than the rest of the single-year rates.

Figure 3.1

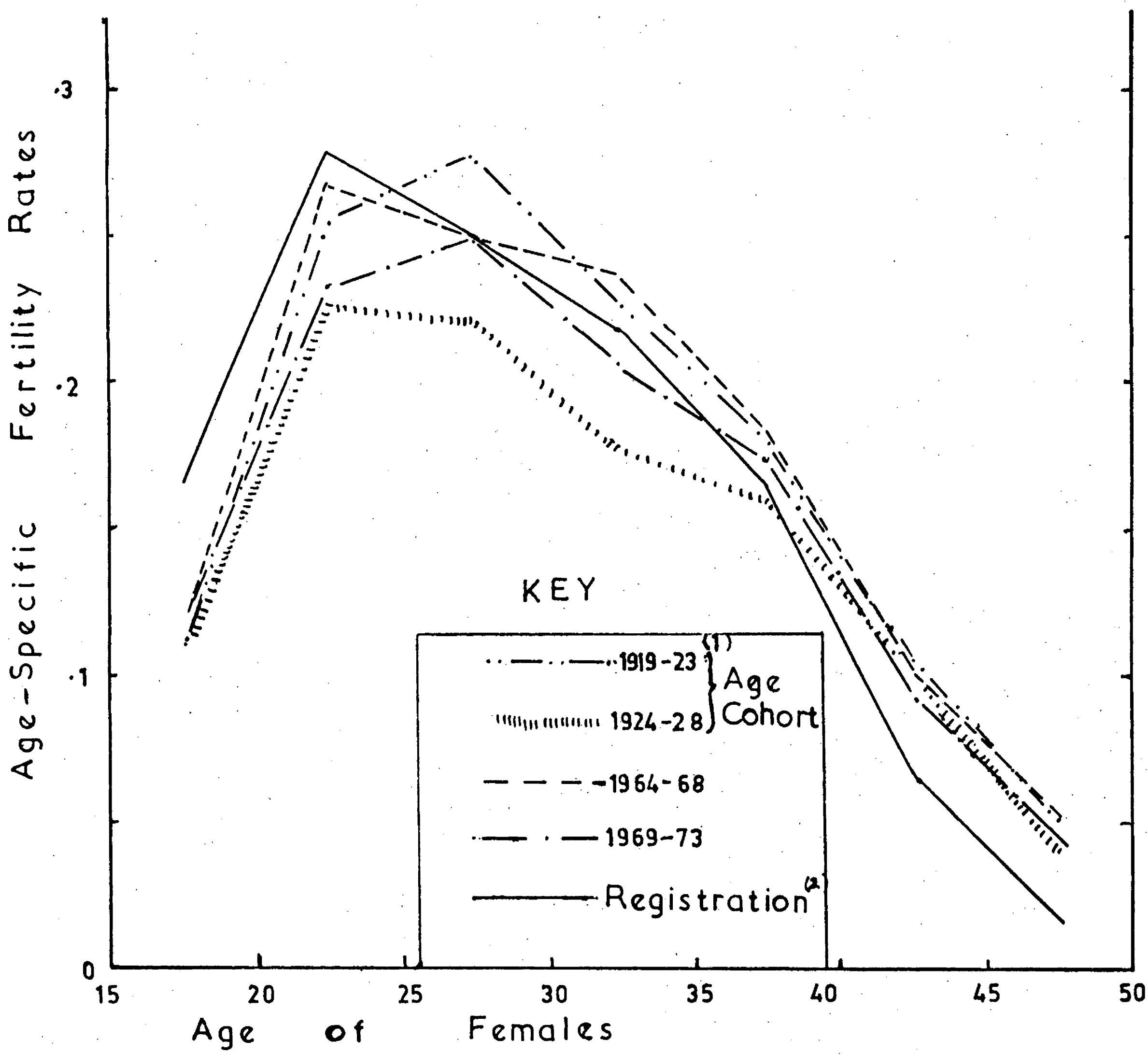
Age-Specific Fertility Rates for Single Years for Selected Years.



Source: Pregnancy History Data, 1974. Cape Coast Project.

Figure 3.2

Age-Specific Fertility Rates in 5-Year Periods for Age Cohort and Cross-Sectional Populations of the Study Area.



Sources: (1) Pregnancy History Data, 1974. Cape Coast Project.
(2) Jain (forthcoming)

3.2.5 Possible Reasons For The Characteristics Of The Fertility Rates.

In areas where not much importance is attached to age and/or date of birth, pregnancy history data are likely to suffer from age mis-statement and event misplacement. Under-reporting arising from memory decay also occurs due to the time span covered in the survey. Because of these errors the possibility of recording change where none occurred or exaggerating a minor change is very great. In Table 3.5, there is an indication that fertility has declined over the past ten years. The question is how genuine is this decline. It may be the result of fluctuations, age mis-statement, event misplacement and/or under-reporting within the last five years. The last reason is less likely than the rest. The aim of this section, then, is to examine the observed fertility rates to find out whether the recorded changes are real or not.

McDonald et al (1976:19-23) have given four possible reasons for the observed changes in fertility rates from pregnancy history data. A fifth reason, event misplacement, is added so as to distinguish between mis-statement of the mother's age and the misplacement of the date of an event. These two errors can occur in conjunction with or independent of one another. The reasons are:

(1) The procedures in the computer programme;

(2) Under-reporting;

(3) Age mis-statement;

(4) Real decline in fertility; and

(5) Event mis-statement.

These are discussed below.

3.2.5.1 The Procedures In The Computer Programme. -

There are two procedures in the programme that can affect the derived data for calculating the fertility rates thus giving rise to the observed changes. These are:

(a) The procedure used in calculating date of birth of mother from age reported in completed number of years;

(b) The allocation of a month of birth to children whose month of birth was not reported.

Because the women's ages were reported in completed number of years, a formula was used to calculate their years of birth. (See Chapter Two.) The calculation yielded the same number of women in each age group as the distribution of women from the 1974 survey. This implies that the distribution of women was not affected by the formula employed. The same logic was used in matching the year of birth of child to that of the mother at the time of birth (of the child).

The second problem involved the allocation of month to children whose month of birth was not reported. This was done by successively allocating January to December to these births as they were encountered. A re-check of the results using an SPSS programme gave the same distribution of births by age.

Hence, there is no reason to suspect that the procedures used in deriving the raw data for the calculations of the rates and ratios contributed to the observed changes.

3.2.5.2 Under-reporting -

Omission of events in surveys and censuses leading to under-reporting has received considerable attention in demographic studies. (See, for example, Bogue and Bogue 1970:9; Chandra Sekhar and Deming 1944:101-115; and Som 1973:121-144.) According to the Bogues, fertility rates from pregnancy history data are under-reported by between 5 and 10 per cent, depending upon the quality of the reporting. Evidence from the data indicates that total fertility and completed family size have remained fairly constant over the recent past at between 5.6 and 6.0. These rates compare very well with the registration data which give a total fertility rate of 5.8 in 1974-77. Thus there is no indication of any serious under-reporting in the pregnancy history fertility rates as compared with the registration system.

The total fertility rates from both the registration system and the pregnancy history are not different from those observed for the rural Western Region. Completed family size for women aged 50 years and over in rural Western Ghana has been estimated as 6.0 in 1968/69 (Gaisie 1976:169), and among the Wassaws to be 6.5. (Gaisie 1972:86). The total fertility rate for the Wassaws was estimated to be 5.3 for 1960 (Gaisie 1972:87). Except the completed family size of the Wassaws, the rest of the rates are the same as those observed from the pregnancy history data. In the light of these similarities, some of the reported fertility rates from the pregnancy history can be accepted as being correct. Internal consistency checks are, however, needed to reveal some of the possible under-reporting errors in the data especially in the earlier years.

The calculation of sex ratios at birth and infant deaths is one of the internal consistency checks. The nature of the ratios give some idea about the quality of the reporting of one sex as compared with the other. In areas where both sexes are under-reported equally, this procedure is not of much use. In Table 3.8, the sex ratios are tabulated by age of mother and period before the survey. The over-all sex ratio at birth of 100 males per 100 females, indicates that male births are slightly under reported compared to female births for the observed ratio for the area is 103.8 males per 100 females (Jain forthcoming). Among the 40-44 and 45-49 age cohorts, for example, sex ratios are very low revealing possible under-reporting of male births. This reason may partly account for the low fertility rates among women in these two age groups. This better reporting of female births than male ones may be related to the social set up of the area whereby inheritance is through the females. It must, however, be remarked that the small number of reported events can lead to such variations in sex ratios at infant death.

Sex ratios at birth in single years since 1950 are shown in Table 3.9. Female births seem to be better reported between 1951 and 1957 than male ones. Between 1958 and 1960 the female births are less well reported. Although under-reporting can account for the observed patterns of sex ratios at birth, it may be unreasonable to attribute all the differences to under-reporting because other errors, such as event misplacement, and the small number of reported births per year can give similar results. The major distortions in the single-year rates are firstly, heaping at multiples of five years from the date of the survey; and secondly, very low reporting in the 13-24 months before the survey. These errors hardly arise from under-reporting of events. The five-year rates have some characteristics which cannot be fully attributed to under-reporting. One such characteristic is the high rates in the 5-9 years before the survey, a feature which according to Potter (1977a:359-360), is associated with event misplacement. There is however, no doubt that under-reporting may partly explain some of the observed differences in the fertility rates.

Table 3.8

Sex Ratios at Birth by Age of Mother and Period before the Survey. Study area ('00 Females)

Exact age of Women at time of Survey	40–35	35–30	30–25	25–20	20–15	15–10	10–5	5–0
55								
50								*
45							*	74
40						74	91	88
35					94	98	86	91
30				124	100	88	106	102
25			73	74	82	106	100	117
20		100	100	103	100	93	118	90
15	*	161	80	102	106	105	113	97

Years before survey (40, 35, 30, 25, 20, 15, 10, 5, 0)

* Less than 30 Births.

Source: Pregnancy History Data, 1974. Cape Coast Project.

Table 3.9

Sex Ratios at Birth for the Study Area 1950-73
('00 Females)

Year	Sex Ratio ('00 females)	No.
1950	114	276
1951	96	216
1952	83	286
1953	99	265
1954	87	359
1955	92	315
1956	91	444
1957	92	439
1958	109	469
1959	105	505
1960	110	498
1961	90	491
1962	102	598
1963	91	555
1964	96	697
1965	96	642
1966	100	700
1967	106	664
1968	113	764
1969	99	778
1970	99	823
1971	124	822
1972	95	839
1973	99	850

Source: Pregnancy History Data, 1974. Cape Coast Project.

3.2.5.3 Age Mis-statement. -

This error involves the inability of women to report their ages or date of birth correctly. There has been an observed tendency among Ghanaian young females to over-state and the old ones to under-state their ages. There is an added distortion of age schedules associated with preference for digits ending in 0, 5 and other even numbers. These errors highlighted in Chapter Two, greatly affect the distribution of fertility rates.

Age mis-statement can combine with other errors, mainly event misplacement, to distort fertility schedules and thus makes it difficult to isolate this problem in any discussion on pregnancy history data. A hypothetical example may help to clarify this point. Assume a woman who has one child, reports her age as three (3) years older than her actual age. She may either increase the age of her child by the same number of years so as to maintain the gap between her age and that of her child or report her child's age correctly. Where the woman increases her age and that of her child, the time of birth will be shifted forward as a result of both age mis-statement and event misplacement. An 'older' fertility schedule will occur with age mis-statement only. Similarly, a 'younger' fertility schedule will result from under-estimation of age with or without event mis-statement. In Table 3.5, therefore, the high fertility rates in the 5-9 years before the survey may occur as a result of either over- or under-statement of ages among younger and older women respectively as was observed in the reported ages in the survey or through event misplacement operating independently or in combination with age mis-statement. Presently it is difficult to state categorically whether a reported 'younger' or 'older' fertility schedule is the outcome of age mis-statement or event misplacement or both. Further research is needed to resolve these problems.

3.2.5.4 Real Decline In Fertility -

There is no indisputable evidence in the data to show that fertility has declined over the last 40 years or so. There is some evidence of under-reporting among older women coupled with event misplacement and age mis-statement. The difference of 7 per cent in total fertility between the 5-9 and 0-4 years before the survey is more the outcome of age mis-statement and/or event misplacement in the data than anything else. There is evidence of shifts in events and in the ages of women from younger to older ages and vice-versa in the data. Event misplacement also occurs in the data (next section) leading to distortions in fertility schedules over time. It is, therefore, difficult at this stage to indicate whether there have been any genuine changes in fertility in the area or not. One will be able to tell after the data has been adjusted for some of these errors. Some adjustments are tried in the next chapter.

3.2.5.5 Event Mis-placement -

Until quite recently event misplacement errors in pregnancy history data had not been given the serious attention they deserved. Bogue and Bogue (1970:9) mentioned it only briefly. Brass (1971b:10-15), although he recognised the problems and discussed them extensively, did not fully grapple with their effect on observed fertility rates. It was Potter (1975:17-49; 1977a:341-349) who demonstrated effectively how event misplacement affects the distribution of births. Although event misplacement errors are now recognised, no reliable procedure has been developed to circumvent the problem posed by these errors. In the 5-year age-specific rates (Table 3.5), fertility declined over the last ten years. This feature, according to Potter (1977a:350), is associated with event misplacement. Secondly, in the 35-39 age cohort, fertility is not consistently high with increasing age of the cohort. In broad terms, women aged 35 and over at the time of the survey tended to report older fertility schedules. This tendency is also associated with "event misplacement processes." (Potter 1977a:350).

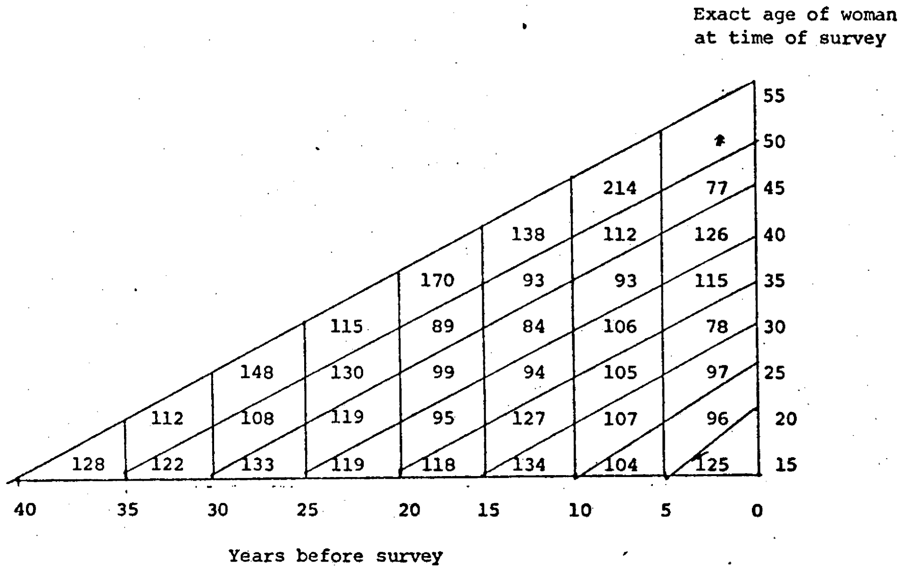
The distribution of children dying by age of mother and years before the survey gives an indication of the quality of the event reporting. If mortality has been declining, the proportion of children dying up to a particular age is positively related to the age of mother and period before survey. This expected pattern is encountered in only a few places in Tables 3.10 and 3.11 which show the proportion of children dying up to exact ages 2 and 5 respectively by age of mother and years before the survey. In both tables the proportion of children dying at each age among women aged 35 and below at the time of the survey rises with increase in period before the survey. In the case of the proportion dying at exact age 2, there is a general tendency among women under aged 35-44 at the time of the survey to report deaths over the last ten years close to the date of the survey. Women in the age cohorts under 30 seem to shift events into the past. This is well marked among the 25-29 cohort. This may be partly due to the fact that older women in Ghana tend to put events further into the past while women in the 35-45 age groups under-state their ages to make them younger. The younger women, on the other hand, inflate their dates of birth and that of their children (if any) (Seltzer 1973:12-15; Gaisie 1976:78). Despite these observations among Ghanaian women one can not rule out the effects of small numbers in the cells as contributing to the observed characteristics.

Table 3.10

Proportions Dying between Birth and Exact Age 2

$q^{(2)}$ by Age of Mother and Period Before Survey. Study

Area ('000 Population)



* Less than 30 Deaths.

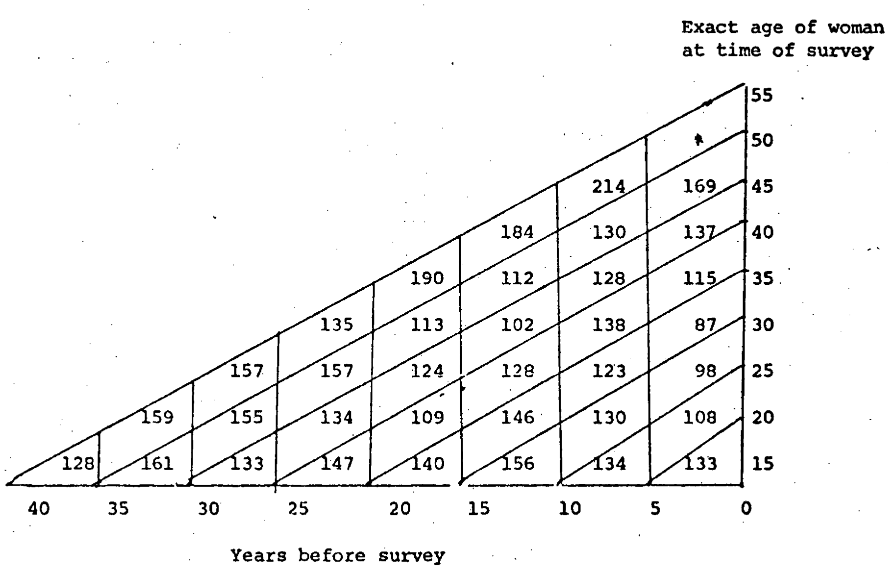
Source: Pregnancy History Data, 1974. Cape Coast Project.

Table 3.11

Proportions Dying between Birth and Exact Age 5

$q^{(5)}$ by Age of Mother and Period Before Survey. Study

Area ('000 Population)



* Less than 30 Deaths.

Source: Pregnancy History Data, 1974. Cape Coast Project.

The proportion of children dying up to exact age 5 (Table 3.11) seems to be better reported than those dying up to exact age 2. Fluctuations are less in the former than the latter. As in Table 3.10 the age cohorts 35 and over in Table 3.10 tend to shift events to the 5-9 years before the survey and further into the past. This tendency to shift events may plausibly account for the observed rise and fall in fertility and the proportion dying at exact age 5 over the last 15 years.

Sex ratios at birth can also be used in evaluating the data for event misplacement. From Table 3.8 one can infer that event misplacement has occurred among all the births reported by the various age cohorts. It seems the women in the area tend to under-state the ages of female children and over-state those of the males. In other words, the dates of birth of female children are shifted close to the survey data while those of males are shifted into the past. For example, among the 30-34 women the period 10-14 has more females than the previous five-year period. This cannot be explained entirely by fluctuations in male or female births from one period to the other or in under-reporting of one sex in a particular period. One plausible explanation is the shifting of female births in the 15-19 to the 10-14 years before the survey and/or the reverse for male births. Another possibility might be age mis-reporting among the women. The two reasons of event misplacement and age mis-statement may be related to the fact that in Akan societies the girls hang around their mothers much longer than the boys and therefore their ages are more likely to be under-estimated by respondents or interviewers. Alternatively the boys' ages may be over-stated. This trend in age reporting is reversed in young adult ages when the ages of the females are over-stated to conform to their new status in the society as young adults and mothers.

As pointed out earlier, it is difficult to isolate event misplacement from other errors especially, the mis-statement of age among women. These errors combine in various forms to give rise to the observed differences and distortions. There is no doubt that these errors account for the changes in fertility over the last 15 years in Table 3.5. It must also be remarked that the small size of the sample can contribute to the observed characteristics.

3.3 CHILDHOOD MORTALITY

3.3.1 Introduction

Pregnancy history data provide time-series mortality estimates as well as a means for correcting fertility rates if there is any reason to suspect that the reported fertility rates are incorrect. Potter (1977a:351), for example, has suggested that information on sex differentials at infant deaths should be used in adjusting reported fertility estimates, if they happen to be incorrect. However, this procedure cannot be used if infant deaths are poorly reported.

Pregnancy history data has been found to be inadequate for estimating adulthood mortality due to the small number of reported deaths at these ages, especially if the sample population is small. As a result mortality analysis from the method have been restricted to the young age groups, in most cases deaths up to exact age 5. In spite of this problem some researchers have used data from the method in estimating mortality to the young adult ages. By following various age cohorts, the proportion dead and surviving at specific ages can be calculated to give life table equivalents of qx and lx values. Hull (1975:226-232) has used such a procedure to calculate the proportion dead and surviving for selected ages up to age 20.

This section presents infant mortality rates from pregnancy history data for the study area from 1950-72, first in single years and secondly, in 2 different 5-year periods. In a further analysis the infant mortality rates are presented for the 8 villages, grouped into three clusters. First is the cluster of five settlements located about 30 kilometers west of Sekondi-Takoradi, the regional capital; next is Asankrangwa, the major settlement in the study area, and lastly, the 2 settlements near the Ivory Coast border. Furthermore, the probabilities of dying up to exact age 5 are presented. Results from the various estimates are compared with similar mortality estimates for total Ghana, sub-populations of Ghana, some other African countries and those for the study area derived from other sources such as the registration system and children ever-born and surviving data.

3.3.2 Infant Mortality.

The quality of infant mortality data is generally affected by

1. under-reporting of events, especially if the deaths occurred within the first few hours of birth;

2. the unreliable distinction between still-births and deaths occurring soon after delivery; and

3. mis-reporting of age, which causes an inability to distinguish between children dying before or after age 1.

These drawbacks in the quality of infant mortality data are acute in retrospective surveys, particularly pregnancy history data (Tsui and Bogue 1978:12-14).

Infant mortality rates from 1950 to 1972 for the study area are presented in Table 3.12 for the combined sexes and for males and females separately. The rates fluctuate widely from year to year ranging from 124 deaths per thousand live-births in 1950 to 53 in 1956. The rates peak in the 20, 15, 10 and 5 years before the survey and in 1966 and 1972 - the 2 years of military take-overs. The last situation may have occurred through the use of the Calender method in fixing date of birth if the date could not be readily obtained. The fluctuations are more pronounced in the earlier periods than in the later periods (Figure 3.3). It must be noted that the fluctuations are not different from that observed from the thirty-seven compulsory vital registration areas of Ghana (Table 3.12). The fluctuations make it difficult to establish any trends. Out of the 23 calculated rates, 10 are between 80 and 100, but they are scattered through the period. The rates for 1951, 1966 and 1972, for example, are all 95.

Some of the low-rate periods coincide with or immediately follow years of mass innoculation against poliomyelitis, measles and smallpox, the major child killers in Ghana, as in 1964 and 1967 (African Research Bulletin 1964:195 and 1967:809) and the provision of pipe-borne water in some of the villages. For other low-rate years it is difficult to offer any plausible reasons for the observed rates, for example, those of 1956, 1960 and 1962. These very low rates can hardly be attributed to improvements in health facilities, medical care, diets and social overheads like roads and pipe-borne water. Had the low rates for these years been due to these variables the rates would have either continued to decline or stayed around the low levels. Instead, the rates rose again after the reported low ones. The results thus make one suspect yearly fluctuations in events, under-reporting in some years and/or reference period errors in the data.

Table 3.12

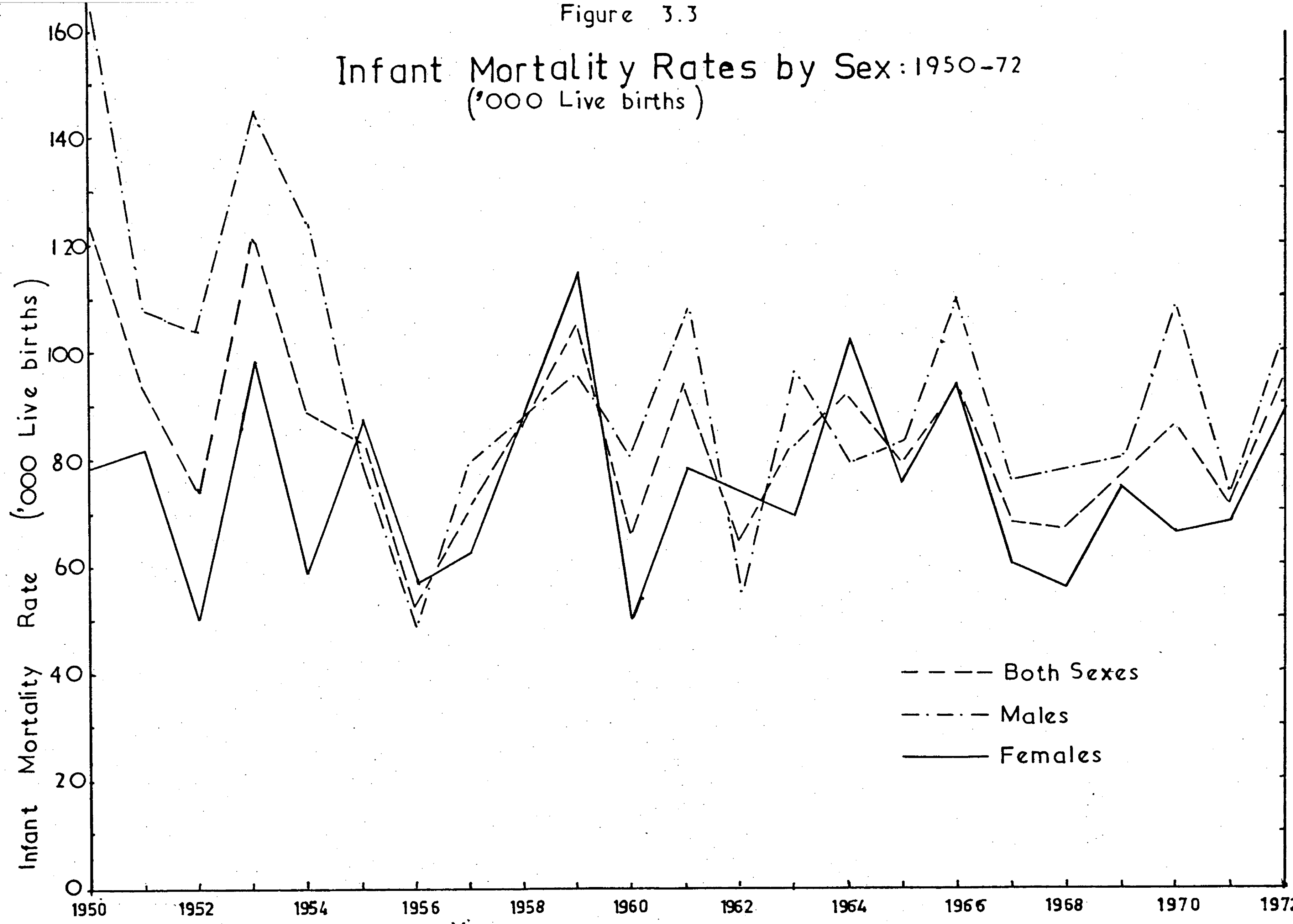
Infant Mortality Rates by Sex and Sex Ratios at Infant Death for the Study Area and Compulsory Registration Areas of Ghana. 1950-72 ('000 live-births)

	Study Area (a)			Compulsory Registration Areas (b)	Study Area Sex Ratios at
	Infant Mortality Rate ('000 live-births)				Infant Deaths
Year	Total	Male	Female	Total	('00 females)
1950	124	163	79	121	235
1951	95	108	82	117	128
1952	74	104	50	125	175
1953	122	146	98	113	148
1954	89	124	59	110	185
1955	84	81	87	109	86
1956	53	50	57	98	80
1957	71	79	63	89	114
1958	87	89	86	70	113
1959	105	95	116	101	85
1960	65	80	50	113	177
1961	93	109	78	95	125
1962	64	55	73	99	76
1963	82	97	69	96	128
1964	91	79	103	95	74
1965	79	83	75	74	105
1966	95	111	78	90	142
1967	68	76	60	88	132
1968	67	78	56	-	158
1969	77	80	75	-	104
1970	87	109	66	-	162
1971	71	74	68	-	121
1972	95	101	90	-	108
Minimum	53	50	50	70	74
Maximum	124	163	116	125	235

Sources: (a) Pregnancy History Data, 1974. Cape Coast Project.
(b) Kpedekpo (1971) p 80

Figure 3.3

Infant Mortality Rates by Sex: 1950-72
('000 Live births)



Source: Pregnancy History Data, 1974. Cape Coast Project

When grouped into five-year periods the rates show some unusual characteristics. The five-year groups from 1950-54 to 1965-69 show different results from those of the 1953-57 to 1968-72 five-year groups (Table 3.13). The former shows some decrease in infant deaths from 100 in 1950-54 to 77 in 1965-69, a decrease of 23 percentage points. The latter, on the other hand, reveal low rates of 80 for both the first and the last periods, with 86, the highest, reported for 1958-62. This gives a decrease of 8 percentage points between 1958 and 1972. The low rate of 80 for the 1953-57 period in the latter grouping points to obvious under-reporting of deaths in the second half of the 1950s. That earlier events are less likely to be remembered and reported in retrospective surveys is evident from the rates. This makes one a bit sceptical in accepting the calculated rates as depicting the level and trends of infant mortality existing in the survey area.

Table 3.13

Infant Mortality Rates in Two Five-year Periods. Study Area 1950-72. ('000 live births)

Second Group		First Group	
Year	Infant Mortality Rate ('000 live-births)	Year	Infant Mortality Rate ('000 live-births)
1950-54	100	1953-57	80
1955-59	81	1958-62	86
1960-64	79	1963-67	83
1965-69	77	1968-72	80

Source: Pregnancy History Data.

In Table 3.14 the same infant mortality data are grouped into three according to the location and status of the settlements (see section 3.3.1). The yearly rates fluctuate so widely that one cannot establish any trends in infant mortality. When grouped to cancel out some of the reference period slippage errors and yearly fluctuations, the group 1 settlements provide the plausible infant mortality rates for the period 1958-72. The rates for Asankrangwa, on the other hand, show some trend of decreasing infant mortality which may be the situation in the whole area but obscured in area 1 by under-reporting and slippage errors. The rates for the third group of settlements in the 1958-72 period are too low to be accepted; for there is no evidence to show that there have been significant improvements in the socio-economic conditions of the area to lead to such low rates.

Table 3.15 shows infant mortality rates from the registration system of the study area, the proportion dead among those ever-born to women aged 15-19 from the 1974 survey, the National Demographic Sample Survey, the compulsory vital registration areas of Ghana and those of Ivory Coast and Senegal. The observed rates from the pregnancy history data are lower than any of the rates presented in the table. It should be pointed out that the rates from the National Demographic Sample Survey and the registration system for the study area, are the adjusted ones and that the observed ones fluctuated from year to year. There is every indication that the area and total Ghana experience high infant mortality rates as most areas in Tropical Africa and that the low rates from the pregnancy history data may possibly be due to under-reporting of infant deaths or event misplacement errors.

Table 3.14

Infant Mortality Rates for Both Sexes, According to Size and Location of Study Village. 1950-72 ('000 live-births)

Year	Infant Mortality Rate ('000 live-births)		
	Group 1	Group 2	Group 3
1950	93	165	138
1951	56	82	188
1952	90	94	69
1953	116	168	122
1954	67	152	83
1955	86	108	85
1956	79	68	20
1957	89	73	51
1958	134	117	38
1959	112	82	127
1960	88	56	51
1961	118	106	75
1962	76	75	60
1963	103	95	56
1964	119	103	53
1965	102	68	70
1966	127	106	65
1967	61	71	87
1968	90	73	56
1969	97	81	70
1970	89	65	107
1971	101	41	70
1972	123	107	78
	Grouped Data		
1953-57	86	107	65
1958-62	105	106	70
1963-67	102	88	66
1968-72	100	73	76

NB Group 1: Mpohor, Banso, Dominase, Ayiem and Nsuaem;
Group 2: Asankrangwa; and
Group 3: Enchi and Yakasi.

Source: Pregnancy History Data, 1974. Cape Coast Project.

Table 3.15

Infant Mortality Rates and Sex Ratios at Infant death for Ghana and Selected African Countries for Various Periods. ('000 live-births)

Area	Year	Infant Mortality Rate ('000)	Sex Ratio at Infant Death ('00 Females)
1. Compulsory Registration Areas of Ghana	1955-60	101	119
	1961-65	NA	125
2. NDSS (Adjusted Rates)			
Rural Western Region	1968-69	118	120
Western Region	1968-69	111	116
Rural Ghana	1968-69	148	124
Total Ghana	1968-69	133	117
3. Cape Coast Project			
Registration (Adjusted)	1974-77	96	120
(Unadjusted)	1974-77	76	95
Brass Q(1)	1974	151	104
4. Selected African Countries			
Senegal Valley	1957	224	NA
Senegal Sine	1963-65	233	NA
Ivory Coast	1957-58	176	NA

NA = Not Available

Sources: 1. Kpedekpo (1970) pp 88 and 89
2. Gaisie (1976) pp 112 and 119
3. Jain (Forthcoming)
4. Cantrelle (1975) p 102

3.3.3 Sex Differentials In Infant Mortality.

Sex differentials in infant mortality are also set out in Table 3.12. Except in five cases males experience higher infant deaths than females. This is the pattern that has been observed for Ghana as a whole (Gaisie,1976:111). Nine out of the 23 male rates exceed 100 per thousand live-births while only 2 of the female rates are in that category. Ten of the female rates fall between 70 and 90. Also the range of the estimated rates is higher among males than females with the males' range being nearly twice as high as the females'. (Table 3.12). These differences between the male and the female rates are well brought out in Figure 3.3. Generally, the rates for both sexes follow the pattern exhibited by the male rates; and that the over-all rates are at their lowest at the same points as the male rates, for example, 1953. This implies that the male under-reporting and slippage errors are higher and are thus able to exert more influence on the over-all rates.

3.3.4 Childhood Mortality.

The level of childhood mortality between ages 1 and 4 ($_4q_1$) in Tropical Africa has not been reliably measured because of age mis-statement. However, the scanty information available indicates that $_4q_1$ is high relative to infant mortality. Clarin (1968:212), for example, has noted that childhood mortality in Dahomey exceeds infant mortality by 20 per cent and accounts for 27 per cent of all deaths. Similar observations have been made by Cantrelle (1975:102) for Mali; and Gaisie (1976:121) for Ghana. This phenomenon of high $_4q_1$ values relative to q(1) are attributed to malnutrition among children after weaning in an area beset with infectious and parasitic diseases (Orraca-Tetteh 1974:61).

In this section observed $4^{q}1$ and q(5) values are presented in the hope that some idea can be obtained about the level and trend of childhood mortality. According to Potter (1977a:352) infant mortality rates from pregnancy history data are less reliable due to event misplacement. It is therefore suggested that q(5) should be calculated and from that infant mortality estimated. The nature of the infant mortality rates in the above sections clearly confirms Potter's observation and q(5) rates are therefore presented with the idea that they are better reported than infant rates.

3.3.5 Mortality Between Ages 1 And 4.

The probabilities of dying among children aged 1 to the end of age 4 ($4^{q}1$) are presented in Table 3.16. The data are presented by sex for both cohort and cross-sectional populations born between 1950 and 1972. Like the infant mortality rates, these values peak at 20, 15, 10 and 5 years before the survey and in 1966 and 1972, the two years of military take-overs, implying a shifting of events to these periods. Furthermore the cross-sectional rates are higher than the cohort rates and suggest better reporting in later years especially of female deaths. Also only 2 of the female cohorts - 1950 and 1960 - show higher $4^{q}1$ values than infant mortality. In the case of 1960, the excess is 71 percentage points and this makes one suspect the accuracy of the reporting. The cross-sectional data, on the other hand, has few cases of higher $4^{q}1$ values than q(1). These are 1956, 1959, in the case of males and 1954, 1970 and 1971 for females. The registration data show similarly varying trends. In the 1974-75 registration period, both male and female infant rates exceeded $4^{q}1$; so also was the 1975-76 female data. For the rest of the registration periods the probabilities of dying between ages 1 and 4 are higher than infant mortality by between 49 per cent (females 1976-77) and 12 per cent (males

Table 3.16

Probabilities of Dying Between Exact Ages 1 and 4 by Sex for Birth Cohorts and Cross-Sectional Population. Study Area : 1950-72. ('000 population)

Birth Cohort			Cross - Section		
Probabilities of dying between exact ages 1 and 4 ('000)					
Year of Birth [(a)]	Male	Female	Year of Death	Male	Female
1950	69	28	1954	83	84
1951	58	45	1955	41	59
1952	22	63	1956	65	47
1953	51	50	1957	62	43
1954	47	35	1958	65	63
1955	54	25	1959	101	72
1956	37	47	1960	75	49
1957	60	49	1961	57	60
1958	74	31	1962	69	65
1959	71	61	1963	57	62
1960	64	86	1964	76	69
1961	55	24	1965	67	61
1962	48	54	1966	56	51
1963	55	52	1967	57	52
1964	55	24	1968	52	52
1965	35	38	1969	61	45
1966	49	63	1970	63	76
1967	44	45	1971	66	75
1968	59	38	1972	65	77
Grouped Data					
Birth Cohort			Cross-section		
1954-58	55	39	1958-62	75	56
1959-63	58	55	1963-67	63	52
1964-68	49	46	1968-72	63	57
			1970-72	66	76
Registration System [(b)]					
1974-77 (Adj)	NA	NA	-	79	77
(Unadj)	NA	NA	-	97	103

NA = Not Available

Sources: (a) Pregnancy History Data, 1974. Cape Coast Project.
(b) Jain (Forthcoming)

1975-76) (See Table 3.16). For the rural Western Region the probability of dying between ages 1 and 4 exceeds infant mortality. The available information for the area therefore, does not give any conclusive evidence on the relationship between $_4q_1$ and q(1) because of age mis-statement and under-reporting.

The observed $_4q_1$ values are, however, low when compared with similar rates from the registration system for the study area and those of total and rural Ghana (Table 3.16). They are also nowhere near $_4q_1$ values estimated for rural Senegal and Togo (Cantrelle 1975:102). Except for the 1970-72 female rate, which comes close to the estimated value for the area based on the registration system, the rest can be said to be implausibly low for a rural community in Ghana.

The low and fluctuating $_4q_1$ rates may be due to a number of reasons. These include changes in childhood deaths, under-reporting, errors due to the small number of reported deaths and possible reference-period slippage errors. The last error is brought out when $_4q_1$ values are compared with their corresponding q(1) rates. The 1960 female rates, for example, show low infant mortality but high $_4q_1$ rates. This indicates possible inflation of the ages at death of children dying to those born in 1960 and/or allocating infant deaths to 1960 births to those of 1961. The outcome is the high infant mortality but low $_4q_1$ among the 1961 birth cohort and vice-versa for the 1960 cohort (see below). Due to such reference period errors it was felt that q(1) and $_4q_1$ rates do not portray the actual mortality conditions in the area and therefore q(5) values should be calculated.

Observed Female $_1q_o$ and $_4q_1$ Rates

for Selected Years. Study Area

('000 population)

Selected Years	$_1q_o$	$_4q_1$
1960	50	86
1961	78	24
1970	66	63
1971	68	45
1972	90	48

Taken from Tables 3.12 and 3.16.

3.3.6 Mortality From Birth to age 5 (q(5)).

Table 3.17 shows the probabilities of dying between birth and exact age 5 by sex for both cohort and cross-sectional populations for children born between 1950 and 1970. The usual zig-zag patterns associated with reported events in Ghana appear in both the cross-sectional and cohort rates; the peaks occur in the same periods as those of q(1) and $_4q_1$. Female rates exceed male rates in only 4 of the 19 reported years for the cohort and cross-section rates. Thus, in general, males experience higher death rates than females. Also worth noting is the marked difference between the cohort and cross-section rates.

Where there is declining mortality, cross-sectional mortality levels are lower than those of cohorts at all ages; and the differences progressively increase with increase in age and period before survey/census (Young,1969:218-228). The difference between the cohort and cross-sectional

Table 3.17

Probabilities of Dying Between Birth and Exact Age 5 for Birth Cohort and Cross-Sectional Populations. Study Area: 1952-72 ('000 population).

Birth Cohort			Cross-Section		
Probabilities of Dying Between Birth and Exact Age 5					
Year of(a) Birth	Male	Female	Year of(a) Death	Male	Female
1950	221	105	1954	196	139
1951	160	123	1955	119	141
1952	123	109	1956	112	101
1953	189	143	1957	136	103
1954	164	93	1958	149	143
1955	130	110	1959	187	180
1956	85	102	1960	149	97
1957	133	109	1961	160	134
1958	156	114	1962	120	134
1959	159	170	1963	149	126
1960	139	131	1964	149	165
1961	158	100	1965	144	131
1962	99	122	1966	161	125
1963	146	117	1967	129	109
1964	129	143	1968	126	105
1965	115	110	1969	136	117
1966	154	136	1970	166	137
1967	116	103	1971	135	138
1968	133	92	1972	160	160
Grouped Data					
Birth Cohort			Cross-section		
1954-58	136	107	1958-62	152	137
1959-63	142	130	1963-67	146	131
1964-68	133	119	1968-72	145	132
Registration System (b)					
1974-77 (Adj)	NA	NA	-	174	159

Na = Not Available

Sources: (a) Pregnancy History Data, 1974. Cape Coast Project.
(b) Jain (Forthcoming).

data in the above table indicates that childhood mortality has been increasing in recent years, a situation which can be possible only when there is a reported outbreak of epidemic, famine or any natural disaster. Since none of these catastrophies has occurred in the study area over a long period, it can be inferred that the difference is due to better reporting of deaths in years close to the survey, and, therefore, makes the cross-sectional data better reported than the cohort data.

Brass' (1968:104-139) technique using information on children ever-born and surviving to women in their reproductive age groups, yields comparable childhood mortality rates. According to Brass (1968) the proportion of children dead among those born to women aged 30-34 at the time of survey corresponds to q(5) from recorded deaths. Sullivan (1972:82) has pointed out that the Brass' q(5) value, on the average, refers to the mortality level at 6.5 years before the survey. This means that derived q(5) values from the 1974 survey refer to the mortality conditions in the latter half of the 1960's.

The Brass' q(5) values which overlap with Sullivan's (1972:83) and Trussell's (1975:103) West model rates (Table 3.18), show higher mortality rates than the cohort and cross-section mortality rates for the same period. In addition the children ever-born and surviving rates show higher mortality among females than males. This, however, is not what has been observed generally for the area. The Brass estimates indicate that the male data is more poorly reported than those of the females and thus accounts for the observed situation of higher female mortality than male. The female q(5) value from the Brass technique may be regarded as the best estimate of female childhood mortality in the area. The rate comes close to the derived q(5) female rate from a life table using an adjusted form of the registration data (Jain forthcoming).

Table 3.18

Q(x) Values from Brass, Sullivan and Trussell's Techniques for the Study Area, 1974 ('000 population).

	Brass		Sullivan		Trussell	
Q(x)	Male	Female	Male	Female	Male	Female
Q(2)	166	155	160	151	159	147
Q(3)	132	130	121	119	124	122
Q(5)	152	160	141	150	147	157

Source: Pregnancy History Data, 1974. Cape Coast Project.

Table 3.19

Probabilities of Dying between Birth and Exact Age 5 for Ghana and Sierra Leone for 1968. ('000 population)

Area	Probability of Dying
1. Total Ghana	187
Rural Ghana	204
Western Region	230
Rural Westarn Region	257
2. Sierra Leone	319

Sources: (1) Gaisie (1976), p 176.
(2) Dow and Benjamin (1975), p 449.

Table 3.19 shows the childhood mortality rates for total Ghana, Western Region (of Ghana) and Sierra Leone. These rates are higher than those observed for the area (Table 3.17). The pregnancy history rates are under-reported by about 20 per cent in the late 1960s and early 1970s as compared to the rates for total Ghana.

It seems the three major drawbacks on infant mortality data set out at the beginning of the section greatly affect the pregnancy history data. In a number of cases deaths are either under-reported or shifted to the next age. Also, some deaths which occurred immediately after birth might have been classified as still-births since most of the births in the area occur at home. Underlying all these errors is the fact that the population involved was not large enough to yield adequate mortality data.

It appears that females experience lower mortality than males. This is a feature which has been observed by Caldwell (1967:42) and Gaisie (1976:111) for total Ghana. There is, however, the problem of establishing the actual relationship between the male and female deaths because of under-reporting. Female deaths from the pregnancy history seem more poorly reported than male ones. This is difficult to explain especially when one remembers that female births are better reported than male ones.

Despite these problems one can infer that childhood mortality in the area is high at the moment and has been higher in the past.

3.4 SUMMARY

The fertility and childhood mortality data from the area have all the characteristics observed about Ghanaian demographic data. These include age mis-statement leading to 'older' fertility schedules, event misplacement and under-reporting of events. As a result of the errors the pattern of fertility rates from both the registration system and the pregnancy history data closely follow what has been observed for Ghana which is characterised by 'implausibly high fertility at the old ages.'

The childhood mortality rates show that the females in the area experience lower mortality than males (except from the Brass estimates which look distorted in the case of the males) as has been the situation for total Ghana. Also, there is some indication that the probability of dying between ages 1 and 4 is as high as, if not higher than infant mortality. The real situation, however, is obscured by reference-period slippage errors and under-reporting. The data also show high and fairly constant fertility over the recent past and high childhood mortality. But there is a question mark on the unchanging fertility and the tempo of the mortality decline as a result of errors. The rates need to be corrected before any meaningful conclusions can be made about the trends, levels and patterns of fertility and mortality in the area from the pregnancy history data.

CHAPTER 4

ADJUSTMENT OF OBSERVED FERTILITY AND CHILDHOOD MORTALITY RATES

4.1 INTRODUCTION.

The fertility and childhood mortality rates and ratios observed in Chapter Three were found to be unreliable due to the effects of under-reporting, event misplacement and age mis-statement errors. Except in a few cases the changes in the observed rates and ratios could not be accepted as being real because of these errors. In addition to individually affecting the observed rates, these errors interact in various ways to give rise to the observed features. For example, it was shown that 'younging' or 'ageing' of fertility schedules can occur through age mis-statement and/or event misplacement.

Up till now no reliable and effective procedures have been developed for detecting and correcting these errors. This is because it is difficult to detect these errors either singly or in combination with one another. Most attempts taken so far have been speculative. This chapter therefore aims at reviewing some of the suggested adjustment procedures and putting forward moving average as a method for smoothing the single-year data for age mis-statement and event misplacements before applying Brass' (1975:44-49) adjustment procedure. The adjusted rates are then inflated for under-reporting (where possible).

4.2 SUGGESTED ADJUSTMENT PROCEDURES

Bogue and Bogue (1970:138) have suggested that age-specific fertility rates among the extreme age groups - 15-19 and 40-44 - should be adjusted downwards due to the "... limited data for ages 15-19 for the five years preceding the interview, and ... [the] progressively less information for the older ages as one goes backward in time." (Bogue and Bogue 1970:138). After this adjustment, the derived rates are then inflated for possible under-reporting. Fortunately, the limitation indicated by the Bogues does not occur in the data used because the lower and upper age limits in this study make it possible to have females in the 15-19, 40-44 and 45-49 age groups. It is therefore suggested that when using the Bogues' programme, the upper and lower age limits should be extended to avoid using the above questionable procedure. Event misplacement and age mis-statement errors are not considered in their adjustment procedures.

For mortality Bogue and Bogue (1970:103, 115 and 131) consider only infant mortality in their programme. The rates provided by the programme are considered to be under-reported by between 25 and 50 per cent. They therefore suggest that the observed rates should be increased by 25 per cent to give 'medium' estimates and by about 50 per cent to give 'high' estimates.

It is true that infant mortality rates from pregnancy history data are grossly under-reported due to recall lapse and positive attempts to forget deaths as it occurs in Ghanaian societies. But there are other errors which equally affect the quality of infant deaths. Event misplacement, for example, is likely to occur in the reporting of infant deaths, because being an event to be forgotten, its placement in time scale becomes difficult when asked to recall. To correct for under-reporting only is to play down the effects of other errors which equally affect observed rates. Due to possible event misplacement errors in infant rates from pregnancy history data, Potter (1977a:352) has suggested that q(2) and/or q(5) rates should be calculated in preference to infant deaths. This is a worthwhile suggestion so far as reported deaths among children in African countries are concerned.

Brass (1971b:10-15 and 1975:44-49), on the other hand, has suggested that observed age-specific fertility rates should be corrected with the distribution of first births for event misplacement errors (see Chapter Two). Potter (1975:17-44) has demonstrated that the distribution of errors in first births is not the same for births of higher orders; and therefore the adjustment procedure using first births does not help to correct event misplacement errors in the observed rates.

Recently, Brass (1977) has evaluated his method and has recommended that first births should be used for adjusting fertility rates for reference-period slippage errors (Chapter Two), where these can be detected. Given the difficulty involved in detecting this error independent of others, it is further suggested that Gompertz's curve should be used in evaluating the reported data. These purely mathematical procedures for evaluating and adjusting pregnancy history rates are less meaningful, as far as this writer is concerned, especially where the direction and the nature of the interaction of event misplacement with other errors are not well established. For this reason the mathematical procedure suggested by Brass is not used in this study. The age specific fertility rates are, however, adjusted using first order births. The aim here is not only to adjust the data, but also to find out the reliability of Brass' adjustment procedure.

Potter's (1977a:351-352) proposal that the evaluation of pregnancy history data should be based on internal consistency checks and comparison with independent sources and adjusted accordingly is adopted here. On the basis of the proposed evaluation procedures, undertaken in Chapter Three, some of the observed rates are adjusted for age mis-statement, event misplacement and under-reporting of events in this chapter.

Firstly, the single-year data on females and births are graduated using moving averages. This procedure is adopted as an attempt to re-distribute mothers and births and on that basis re-calculate fertility rates. After the adjustment, the derived rates are compared with observed patterns from the registration system and with an expected (model) pattern and other distributions. Furthermore, the rates are inflated for under-reporting based on adjusted sex ratios and in comparison with independent estimates.

Infant and childhood mortality rates are also smoothed for fluctuations in births and deaths using moving averages. The smoothed rates are then adjusted for under-reporting on the basis of the level of childhood mortality from the registration system.

4.3 MOVING AVERAGES

Moving average is a simple technique for re-distributing data which is subject to seasonal fluctuations. The procedure, first used by economists, has been adopted by demographers mainly because of its ability to help re-distribute data which are characterised by digit preference as it occurs in age reporting (United Nations 1958:10). It involves taking the measurement for a time period and replacing it with the average of the measurement for that time period and an equal number of periods before and after. For example, a five-year moving average would assign to each year the value of the average for that year's reading plus the readings for the previous and the succeeding two years. For instance, the number of women aged 15-19 in 1971 is the average of the women aged 15-19 from 1969 to 1973. The births and deaths for the calculation of childhood mortality rates are averaged in the same way. The procedure assumes that age mis-statement among women is somewhat related to event misplacement; and that the misplacement of both births and deaths are inter-related. There is also an inherent assumption in the moving average technique: there are no real fluctuations in the fertility and mortality rates among the various [age] cohorts in the three-, five- or seven-year groupings. One disadvantage with the procedure is that one does not get the rates for the most recent years. These assumptions can be questioned in some circumstances. But the procedure enables one to graduate the data on women and on births simultaneously, which has so far not been done for pregnancy history data. All the adjustment procedures put forward so far assume that women's ages are not mis-reported.

4.4 ADJUSTED FERTILITY RATES

Age-specific fertility rates from five-year moving averages using the single-year distribution of births and mothers by age and years before survey, are given in Table 4.1. The years indicated are the mid-points for the five-year average. It should be mentioned that the 1971, 1966 and 1961 rates are exactly the same as the rates for 0-4, 5-9 and 10-14 years in Table 3.5. In general, the moving average rates are better distributed than the observed single-year ones. The unusual schedule of fertility for some years, for instance in 1969, where the 35-39 age group had a higher proportion of births than the 30-34 group, does not appear in the moving average rates.

The age-specific fertility rates decrease gradually over the years among women in the young age groups, mostly the cohorts under 35 at the time of the survey. Fertility among women 20-24 and 30-34, for example, shows a declining trend from 1965 to 1971. The rates for cohorts above 40 at the

Table 4.1

Age-Specific and Total Fertility Rates from the Five-year Moving Average Procedure. Study Area: 1961-71.

Mid-Year of Five-Year Average	Age of Women 15-19	20-24	25-29	30-34	35-39	40-44	45-49	Total Fertility Rate (15-49)
	Age-Specific Fertility Rate							
1961	.139	.251	.250	.226	.160	.105	N.A.	5.7
1962	.131	.249	.251	.226	.173	.099	N.A.	5.6
1963	.126	.265	.250	.243	.173	.096	N.A.	5.8
1964	.130	.267	.258	.228	.180	.092	N.A.	5.8
1965	.121	.275	.256	.243	.177	.095	N.A.	5.8
1966	.119	.269	.250	.238	.184	.101	.051	5.8
1967	.121	.265	.256	.237	.188	.102	.043	5.8
1968	.127	.251	.264	.219	.189	.100	.039	5.8
1969	.126	.248	.262	.224	.185	.104	.038	5.7
1970	.127	.241	.254	.207	.179	.099	.038	5.5
1971	.120	.234	.250	.205	.173	.092	.038	5.4
Maximum	.139	.275	.264	.243	.189	.105	.051	6.1

N.A. = Not Available

Source: Pregnancy History Data, 1974. Cape Coast Project.

time of the survey remain fairly constant.

Total fertility rates based on the moving averages range from 6.1 in 1966 to 5.6 in 1971 among women aged 15-49 (Table 4.2). When graphed, the rates reveal a very flat-topped crescent shape with the zig-zag pattern in the ungraduated data evening out (Figure 4.1). Also the questionably low total fertility rate observed in the 1971 period disappears completely. However, the low total fertility rates in the earlier periods still remain, making one suspect under-reporting in the earlier years.

4.4.1 Brass' Adjustment Procedure

The distribution of age-specific fertility rates of first births, according to Brass (1971b:10-15 and 1975:44-49), can be used in adjusting observed five-year rates from pregnancy history which are subject to event misplacement errors. It is believed that there is a relationship between the age-specific rates of first and all order births. This relationship is expressed as:

$$\frac{\hat{F}_i}{\hat{F}1_i} = \frac{kF_i}{kF1_i}$$

(See Chapter Two, Section 2.2.4)

The relationship between the age-specific fertility rates of first and all order births for the five-year rates for the area are shown in Table 4.3. The ratios at the early part of the reproductive period decrease towards the survey date, suggesting that fertility is declining among the age cohorts under age 35. After age 35, the ratios rise and fall indicating possible shifting or omission of events among older women.

Table 4.2

Per cent of Fertility in Specified Age Groups for the Study Area and Total Ghana.

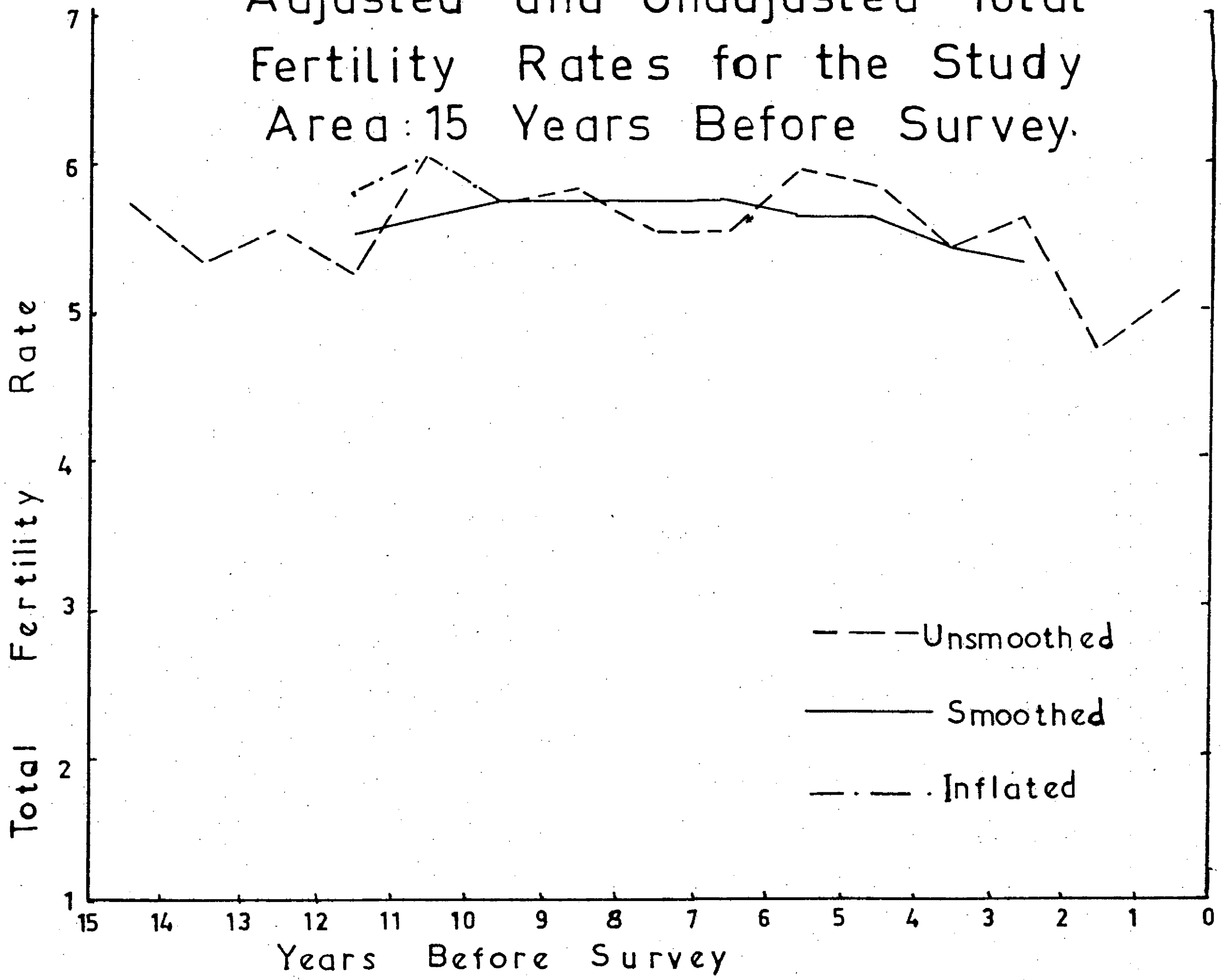
Mid-Year of Five-Year Average[(a)]	Age of Women								Total Fertility
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	Total	
1966	9.8	22.2	20.7	19.6	15.2	8.3	4.2	100.0	6.1
1967	10.0	21.9	21.2	19.5	15.5	8.4	3.5	100.0	6.1
1968	10.6	21.1	22.2	18.4	15.9	8.4	3.3	100.0	5.9
1969	10.6	20.9	22.1	18.9	15.6	8.7	3.2	100.0	5.9
1970	11.1	21.0	22.2	18.1	15.7	8.7	3.3	100.0	5.7
1971	10.7	21.0	22.5	18.4	15.6	8.3	3.5	100.0	5.6
Maximum	11.0	21.7	20.9	19.2	14.9	8.3	4.0	100.0	6.3
Model	11.6	24.4	26.3	21.0	12.4	4.0	0.0	100.0	N.A.
Ghana(1960)[(b)]	10.8	20.8	21.6	19.6	15.0	8.5	3.7	100.0	6.2
(1968)[(c)]	11.4	22.3	21.9	19.5	13.7	7.6	1.0	100.0	6.5

Model based on formulae: $f(x)=c(x-s)(s+33-x)^2$

Sources: (a) Pregnancy History Data, 1974. Cape Coast Project.
(b) Kpedekpo (1976) Appendix Table 2, p 24.
(c) Gaisie (1976) p 92.

Figure 4.1

Adjusted and Unadjusted Total Fertility Rates for the Study Area: 15 Years Before Survey.



Source: Pregnancy History Data, 1974 Cape Coast Project.

Table 4.3

Cumulative Total and First Births per 1,000 Women for Cohorts by 5-Year Periods Preceding Survey.

	Period Preceding Survey								
Age Group at end of	0 - 4			5 - 9			10 - 14		
	Births			Births			Births		
Period	Total	First	Ratio	Total	First	Ratio	Total	First	Ratio
15-19	600	430	1.4	595	390	1.5	695	430	1.6
20-24	1,770	755	2.3	1,945	740	2.6	1,950	690	2.8
25-29	3,020	855	3.5	3,195	820	3.9	3,200	805	4.0
30-34	4,245	890	4.5	4,385	865	5.1	4,330	845	5.1
35-39	4,910	900	5.5	5,305	885	6.0	5,132	900	5.7
40-44	5,370	900	5.6	5,805	895	6.5	5,660	905	6.3
45-49	5,565	900	6.2	6,060	895	6.8	5,660	905	6.3

Source: Pregnancy History Data, 1974. Cape Coast Project.

According to Brass (1975:44-49), such errors of event misplacement can be corrected using the relationship between age-specific first births and age-specific fertility rates. The process involves first, the cumulation of first and all order age-specific rates from the beginning to the end of the reproductive period. To obtain more linear curves, the cumulated age-specific rates are transformed into logits. The proportion of cumulated births to total births at the last age group (eg, 35-39) is set at 0.98 for the logit transformation. The distribution of age-specific first births for the most recent period, 0-4 years before the survey, is used as the standard for adjusting all order births of various age cohorts. The logits of cumulated first order births of an age cohort are plotted against those of the standard on the Y-axis at the point where the values fall on the standard curve. The deviation of the points of the first of an age cohort from the points of the standard curve constitute the amount of event misplacement (in years). These new points, referred to as the corrected points, are then used to plot the logits of all order births for the particular age cohort. The graph for the first birth for the 0-4 period and for the first and all order births of the 35-39 age cohort for the area is given in Figure 4.2. The logits for the corrected age-specifi fertility rates are read off from the points where the curve of all births cross the 5, 10, 15 etc years of the X-axis. The logits are then transformed into proportions and to cumulated fertility rates. An example for the 35-39 age cohort is given in Table 4.4. A detailed description of the method can be found in Brass (1975:44-49).

Results from the area indicate that the shifting of the date of an event is not as consistent among various age cohorts and time periods as Brass assumes in the method. For the 30-34 age cohort, for instance, the shift in date of birth was 1.25 years older in the 0-4 period, 0.25 in the 5-9 period, and 0.5 in the 10-14 period. Thus, the reported births among

Table 4.4

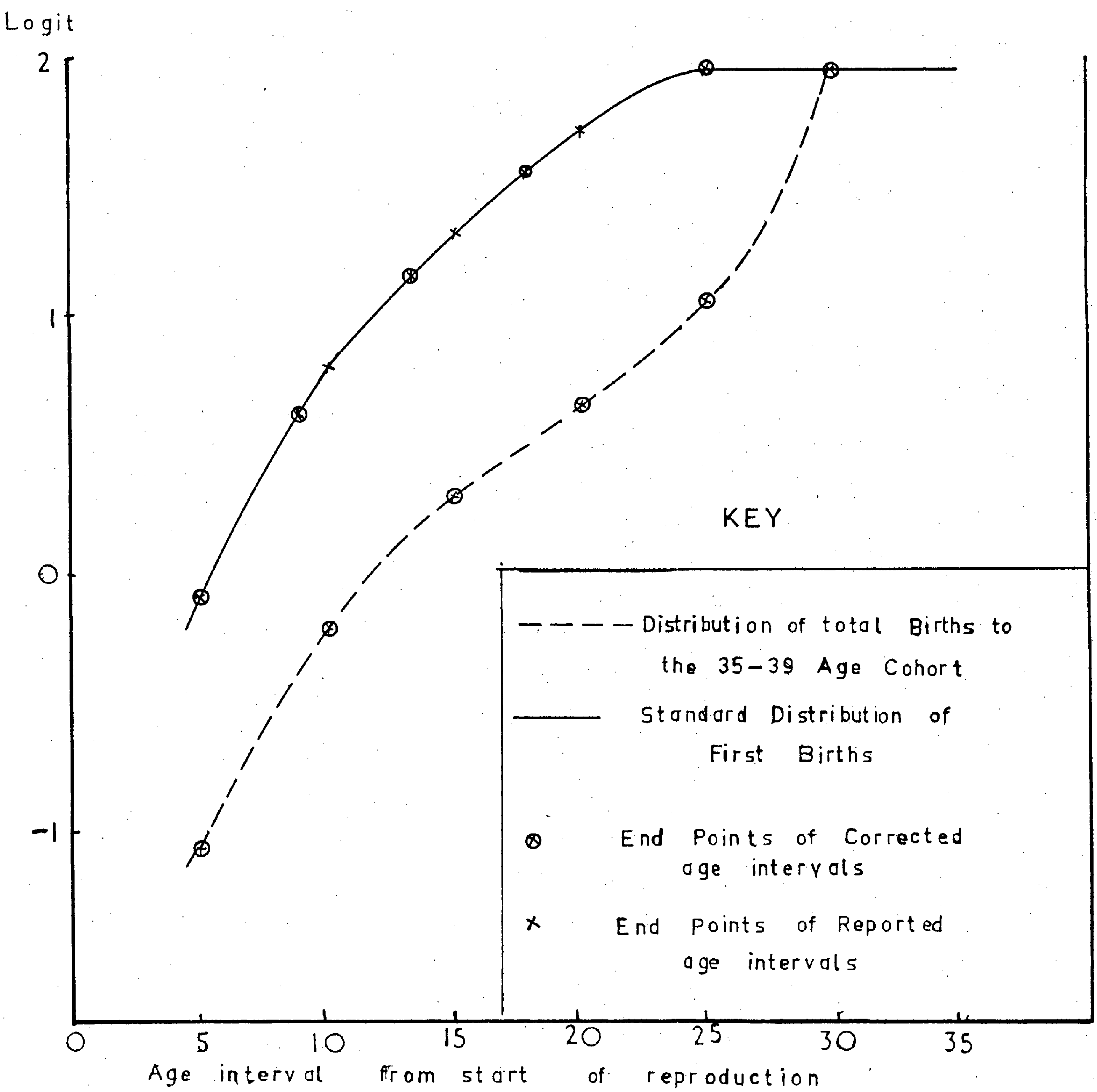
Derivation of Corrections for Cohort of Women aged 35-39 Years

Age Interval from Start of Reproduction	First Births		Reported Total Births		Corrected Total Births		Cumulated Birth per 1,000 Women
	Proportion	Logit	Proportion	Logit	Logit	Proportion	
5	.4099	-.1956	.1087	-1.050	-1.12	.0974	510
10	.7885	.6552	.3499	- .3100	-.225	.3892	2,040
15	.9237	1.249	.5872	.1730	.250	.6220	3,260
20	.9687	1.724	.8141	.7430	.760	.8198	4,300
25	.9800	1.949	.9800	1.949	1.949	.9800	5,140

Source: Pregnancy History Data, 1974. Cape Coast Project.

Figure 4.2

Correction of the Distribution of Births for the Cohort of Women aged 35-39 Years



Source: Pregnancy History Data, 1974. Cape Coast Project.

the 30-34 age cohort are from 0 to 5.5 years instead of 0-4 in the recent period. Among the 35-39 age cohort, births in the 0-4 period were reported 1.25 years older than was actually the case; and there was a younging of children in the 10-14 years period by 0.75 years. This perhaps explains the high fertility rates observed in the 5-9 years before the survey. On the basis of the shifts in date of births for the various age cohorts, the age-specific rates for the 0-4, 5-9 and 10-14 years before the survey were adjusted. The adjusted cumulated rates for all births, shown in Table 4.5, indicate that the births have been re-distributed. The adjusted cumulated rate among the 35-39 age group in the 0-4 years before the survey, for instance, is 4,715 births per thousand women instead of the observed 4,910 (Table 4.3). It should be mentioned that the procedure only re-distributes births and maintains the total births for each age cohort. Nevertheless, the maximum fertility in the 5-9 years before the survey still appears in the adjusted rates giving an impression of rise and fall in fertility over the last 15 years. This, as pointed out earlier, is an improbable situation. It can, therefore, be inferred from the results that the use of first births as a correction factor for event misplacement is not adequate. It seems the timing of errors in first births is not the same for all order births or under-enumeration occurs in the early period. For this reason, the age-specific rates from the moving average data were taken as the plausible estimates for the area.

To assess the validity of the suspected under-reporting of fertility in the earlier periods, an internal consistency check based on sex ratios at birth is undertaken. The data for the calculation of the sex ratios is from the moving average procedure. The results, given in Table 4.6, show that the plausible sex ratio at birth is 103 males per 100 females, the ratio observed for the last 5 years of the survey period, except for 1971. This ratio is close to the 103.8 estimated for the survey area (Jain forthcoming)

Table 4.5

Adjusted Cumulative Total Births per 1,000 Women in 5-Year Period Preceding Survey.

Age Group at end of Period	Period 0 - 4	Total Preceding 5 - 9	Births Survey 10 - 14
15-19	595	585	695
20-24	1,775	1,930	1,930
25-29	3,025	3,475	3,150
30-34	3,915	4,515	3,225
35-39	4,715	5,095	-

Source: Pregnancy History Data, 1974. Cape Coast Project.

Table 4.6

Sex Ratios at Birth Based on Moving Average Data for the Study Area : 1952-70. ('00 females)

Mid-Year of Five-Year Average	Sex Ratio At Birth	No.
1952	95	280
1953	91	288
1954	91	334
1955	92	378
1956	95	419
1957	98	448
1958	102	485
1959	101	494
1960	103	526
1961	99	543
1962	97	582
1963	95	611
1964	97	653
1965	98	666
1966	102	707
1967	103	724
1968	103	760
1969	105	784
1970	103	819
1971	101	836

Source: Pregnancy History Data, 1974. Cape Coast Project.

and Ghana (Kpedekpo 1970:90). If it is assumed that this sex ratio prevailed in the 1950s and 1960s, then it can be inferred that female births are better reported than male births in the earlier periods. In the later periods the two sexes are reported equally, with the exception of 1971 which has possible better female reporting. Based on the above assumption and the plausible sex ratio at birth the low total fertility rates in the earlier periods are inflated by between 2 and 4 per cent, the suspected level of under-reporting of male births. The new rates are shown in Figure 4.1. It should be remarked that sex ratios at birth can differ from year to year in actual situations and that the small number of reported births can lead to fluctuations from one period to the other.

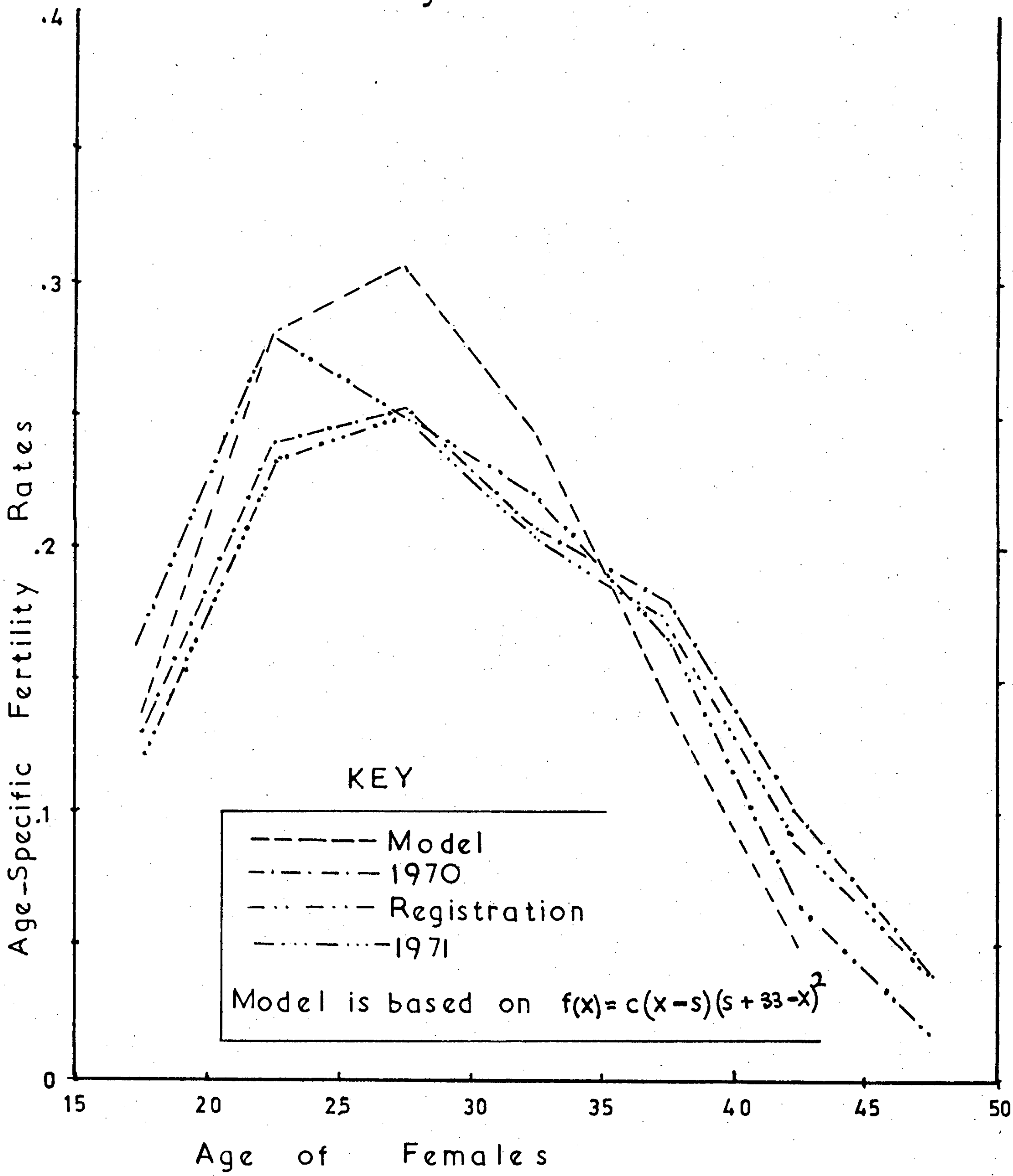
The level of fertility for most of the years, however, seems not to be in much doubt because they are the same as those observed from the registration system for the area (Jain forthcoming) and for the rural Western Ghana (Gaisie 1976:83).

4.4.2 Pattern Of Fertility

In Figure 4.3 the pattern of fertility of the smoothed rates are compared with those of the registration and a model. The model is derived from a mathematical relation using the age "at which fertility begins" (Brass 1975:19) as input (see footnote on Figure 4.3). This age can be obtained by subtracting 13.2 from mean age of fertility schedule. Four of the six patterns of the fertility schedule from the pregnancy history data and the model have broad peaks while the registration data and the other two from the pregnancy history data have early peaks. Before age 35 the model has higher fertility rates than both the registration and the pregnancy history data. After age 35, the pattern is reversed with the registration and the pregnancy history rates being higher than the those of the model.

Figure 4.3

Smoothened Age-Specific Fertility Rates from Pregnancy History, Registration and a Model for the Study Area.



Sources: (a) Pregnancy History Data, 1974. Cape Coast Project.
(b) Jain (forthcoming)

The pregnancy history data have the highest rates at the older ages. This feature of reporting 'older' fertility schedules is observed not only for the study area, but also for total Ghana (Page 1975:43), rural Western Ghana (Gaisie 1976:172) and other Ghanaian rural communities like Danfa (Kpedekpo et al 1976:122). Age mis-statement has been given as the major reason for this state of affairs. However, the high fertility occurring to women in the older age cohorts in the pregnancy history data is possibly not the outcome of age mis-statement only, but also event misplacement, which according to Potter (1975:48; 1977a:339), leads to the reporting of 'older' fertility schedules.

The age structure of fertility for the area and that of the model are converted into Pavlik (1971:37) typology in Table 4.7. The model has the highest fertility among the under 30s; and none of the pregnancy history data gets near to that proportion. One problem with such a model is its rigidity which does not allow for some of the possible changes in marriage and fertility among the young age groups as was speculated above. If the rates from the graduated pregnancy history data can be accepted as being correct, the typology shows that the 15-19 age group for the various years has lower fertility than is expected of a developing country which is characterised by the BCCA pattern. This in a way reinforces the earlier speculation that fertility among the 15-19 age group is somewhat declining.

4.4.3 P/F Ratios.

Brass (1979:27-33), in a just released paper has applied the P/F ratio method to pregnancy history data. Tables of multiplying factors needed to adjust the cumulated age-specific fertility rates are provided for different cohorts of women. These adjustment factors are, however, not very much different from his earlier ones (United Nations 1967:124). The method,

Table 4.7

Classification of Types of Fertility Patterns According to the Proportion of Total Fertility Falling into Specified Age Groups by Pavlik's Model. Study Area and Total Ghana

Mid-Year of Five-Year Average(a)	Age of Women				Pavlik Model
	15-29	15-24	15-19	40-44	
1966	52.7	32.0	9.8	12.5	BCBA
1967	53.1	31.9	10.0	11.9	BCBA
1968	53.9	31.7	10.6	11.7	BCBA
1969	53.6	31.5	10.6	11.9	BCBA
1970	54.3	32.1	11.1	12.0	BCCA
1971	54.2	31.7	10.7	11.8	BCBA
Maximum	53.6	32.7	11.0	12.3	BCCA
Model	62.3	36.0	11.6	4.2	CCCD
Registration(b)	60.1	38.3	14.2	6.8	BCCA
Ghana(1968)(c)	55.6	33.7	11.4	7.6	BCCA

Sources: (a) Pregnancy History Data, 1974. Cape Coast Project.
(b) Jain (forthcoming)
(c) Gaisie (1976) p 92.

according to Brass (1979:27), is inappropriate in certain circumstances. These are firstly, when serious errors of under-reporting of events, especially in the young ages of the older cohorts, occur in the data; and secondly, when event misplacement errors vary according to the age of mother, "or the existence of a fertility trend affects the ratios P_i/F_i". (Brass 1979:27). These errors manifest themselves in the form of increasing P/F ratios with increasing age of mother and/or 'sudden jumps' in the ratios. This means that the data should be scrutinised for abnormalities in the distribution of age-specific fertility rates before the method can be applied.

In Table 4.8, the P/F ratio method is applied to the unsmoothed and the smoothed age-specific fertility rates for selected years. The 1973 unsmoothed ratios, for instance, show 'sudden jumps' from one age group to the other indicating that it is inadvisable to apply the method to the unsmoothed data for 1973. The smoothed data give probable ratios. Three aspects of the ratios from the smoothed data are worth pointing out. Firstly, the ratios for the earlier years, typified by the ratios for 1961, are lower than unity except among the 30-34 age group. Secondly, the ratios show a declining trend among the older age groups for all the years. This decreasing trend with increasing age in the ratios points to possible event misplacement and/or age mis-statement in the data. Thirdly, in all the years the 30-34 age group has the highest ratios. This may be due to the older cohorts' preference for this age group. Nevertheless, the ratios come close to unity in a number of years, particularly 1969 and 1970, revealing that the smoothing has been a worthwhile venture in a number of cases.

One major defect of the P/F ratio method is its acceptance of the derived age-specific fertility schedules as being correct. Where the pattern is defective as a result of the reporting of older fertility

Table 4.8

P/F Ratios from Observed and Graduated Data for the Study Area
(Selected Years)

Age of Women	P/F Ratios: Observed 1959	Observed 1966	Observed 1973	Graduated 1961	Graduated 1966	Graduated 1969	Graduated 1970	Graduated 1971
15-19	.690	.821	1.311	.746	.974	.859	.836	.897
20-24	.861	.931	1.187	.947	.985	1.000	1.010	1.056
25-29	.936	.940	1.143	.988	.944	1.005	1.027	1.059
30-34	1.043	1.058	1.185	1.067	1.065	1.080	1.115	1.143
35-39	.977	.987	1.046	.987	.962	.977	1.013	1.039
40-44	.911	.927	.978	.923	.898	.908	.942	0.970
45-49	-	.884	.950	-	.863	.881	.913	0.939
f1/f2	.544	.494	.398	.554	.442	.508	.527	.513
m	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3

Source: Pregnancy History Data, 1974. Cape Coast Project.

schedules as it occurs in Ghanaian data, this method is not effective in correcting the observed age-specific fertility rates among the older age groups. It is therefore not surprising that the ratios in the older ages are less than unity and decrease with increasing age of women.

4.4.4 Fertility Change

Earlier, it was suspected that fertility among the young age groups was declining. This suspected change in fertility is a phenomenon that has been observed in Ghana generally between 1960 and 1970; and which has been attributed to increase in age at first marriage. According to Aryee and Gaisie (1979:14) age at first marriage is gradually increasing in Ghana due to the wide-spread of formal education. More girls are attending school and staying longer than used to be the case a few years ago. Information on age at first marriage from the study area indicates that the median age at first marriage in the area is decreasing (Table 4.9). Median age at first marriage has declined from 18.8 among the 45-49 age group, to 18 years among the 20-24 age group. The available evidence from the area, therefore, does not support this hypothesis of increasing age at first marriage in the total Ghanaian society. This may, however, be due to the poor quality of the reported age at first marriage data and the small size of the study population. By age 30 nearly all the women in the area were either in stable marital unions, divorced or widowed, and about 60 per cent or more were still married at age 50 (Table 4.9).

The data on mean age of mother at birth of first child, however, indicate that the younger women are giving birth later than the older ones. Among the women aged 35 years and over at the time of survey, the mean age at birth of first child was under 19.5 years. The women under 35 years of age, on the other hand, gave birth to their first children when they were

Table 4.9

Median Age at First Marriage and the Proportions Currently and Ever-Marrried for the Female Population of the Study Area. 1974

Age of Women	Median Age at first Marriage (Years)	Per Cent Married Before Age 21	Per Cent Currently Married	Per Cent Ever-Married	Total
15-19	17.2	-	24	31	1148
20-24	18.0	65	64	81	949
25-29	18.3	69	75	94	820
30-34	18.1	77	75	98	606
35-39	18.2	76	76	99	582
40-44	18.6	68	75	99	431
45-49	18.8	65	61	99	384
Total	18.3	61	-	-	5400

Source: Pregnancy History Data, 1974. Cape Coast Project.

aged 19.5 years or more. Similar changes can be observed in the ages at birth of second and third order births (Appendix B4). Though such data is subject to truncation errors, it can be speculated from the available information that fertility among the young age groups is changing. The increase in the proportion of females attending school partly accounts for this change.

Ninety per cent or more of the female population aged 35 years and over had no formal education as compared with 46 and 28 per cent for the 20-24 and 15-19 age groups respectively. Among the 15-19 age group, 52 per cent of the school going population are in the upper sector of the first cycle (middle school) (Table 4.10). This increasing female participation in formal education is believed to be influencing the age at birth of first child and consequently the pattern of age specific fertility but not total fertility rates.

Available evidence indicates that fertility in the area is high and fairly constant. There is also a suspecion that fertility among the young age groups is declining. However, the magnitude of this change cannot be determined as a result errors in the data.

4.5 ADJUSTED INFANT MORTALITY RATES

Infant mortality rates based on a five-year moving average procedure are given in Table 4.11. The rate for both sexes range from 75 to 100 deaths per thousand live-births in the 19-year period from 1952 to 1970. The rates vary according to sex and it appears that males experience higher mortality than females. The male rates, though fairly constant, seem to decline over the years. Unlike the male rates, the female ones show a relatively constant mortality over the study period. This may, possibly, be

Table 4.10

Female Population by Age and Grade of Education.
Study Area: 1974. (In Percentages).

Age of Woman	Level of Education						Total	Number
	None	Primary	Middle	Secondary	Teacher Training	Other Higher		
15-19	28	15	52	4	0	0	100	1181
20-24	46	10	39	2	2	1	100	991
25-29	69	5	23	0	2	1	100	856
30-34	85	4	10	0	1	0	100	627
35-39	91	3	6	0	0	0	100	598
40-44	96	1	3	0	0	0	100	453
45-49	96	1	3	0	0	0	100	391

Source: Jain (1978) p 49.

Table 4.11

Infant Mortality Rates by Sex and Year of Birth based on Five-Year Moving Average Data for the Study Area. 1952-1970. ('000 live-births)

Mid - Year of Five-Year Average	Infant Mortality Rate ('000 live-births)		
	Total	Male	Female
1952	100	130	71
1953	92	112	73
1954	81	96	68
1955	80	91	70
1956	76	83	70
1957	81	79	82
1958	77	79	75
1959	85	90	79
1960	82	84	80
1961	81	86	77
1962	79	82	77
1963	82	83	81
1964	82	85	80
1965	83	89	78
1966	80	85	75
1967	77	85	69
1968	79	91	67
1969	75	83	66
1970	80	88	72

Based on Appendices C1 and C2

due to under-reporting in the earlier periods and/or other errors. There is no reason to suspect that the level of female infant mortality in the 1950s was better than or the same as those of the early 1970s. The derived rates seem too low to be accepted for a rural community in Ghana. All available evidence show that infant mortality in most rural areas of Ghana exceeds 90 per thousand live-births. The low rates obtained from the data, therefore, indicate that the pregnancy history data are under-reported.

It has been observed that sex differentials in infant death are affected by variations in the quality of the reporting of events to the two sexes. For instance, male events especially deaths, are considered to be better reported than female ones (Potter 1977a:351; Brass 1979:25). One means for checking this difference in reporting of infant deaths is to calculate sex ratios at death. The ratios for the area based on the moving average data are shown in Table 4.12. The over-all sex ratio at infant death from this calculation is 118 males per 100 female deaths. This ratio is close to the one derived for the area from the registration system, which is 120, and 117, the estimate for total Ghana based on the data from the compulsory registration areas (Kpedekpo 1970:88). In effect, deaths for both sexes are equally well- or under-reported. The distribution, however, shows variations from year to year. The ratios are high in the early and later years leaving a trough in the middle (Figure 4.4). Such a feature is indicative of event misplacement whereby male events are pushed further into the past or close to the survey date than they actually occurred. This partly explains the high male infant mortality rate in 1952. One can not, therefore, put much confidence in these rates.

The moving average procedure was applied to the data from each of the three groups of settlements created in Chapter Three as well. The infant mortality rates from these calculations are given in Table 4.13. The group

Table 4.12

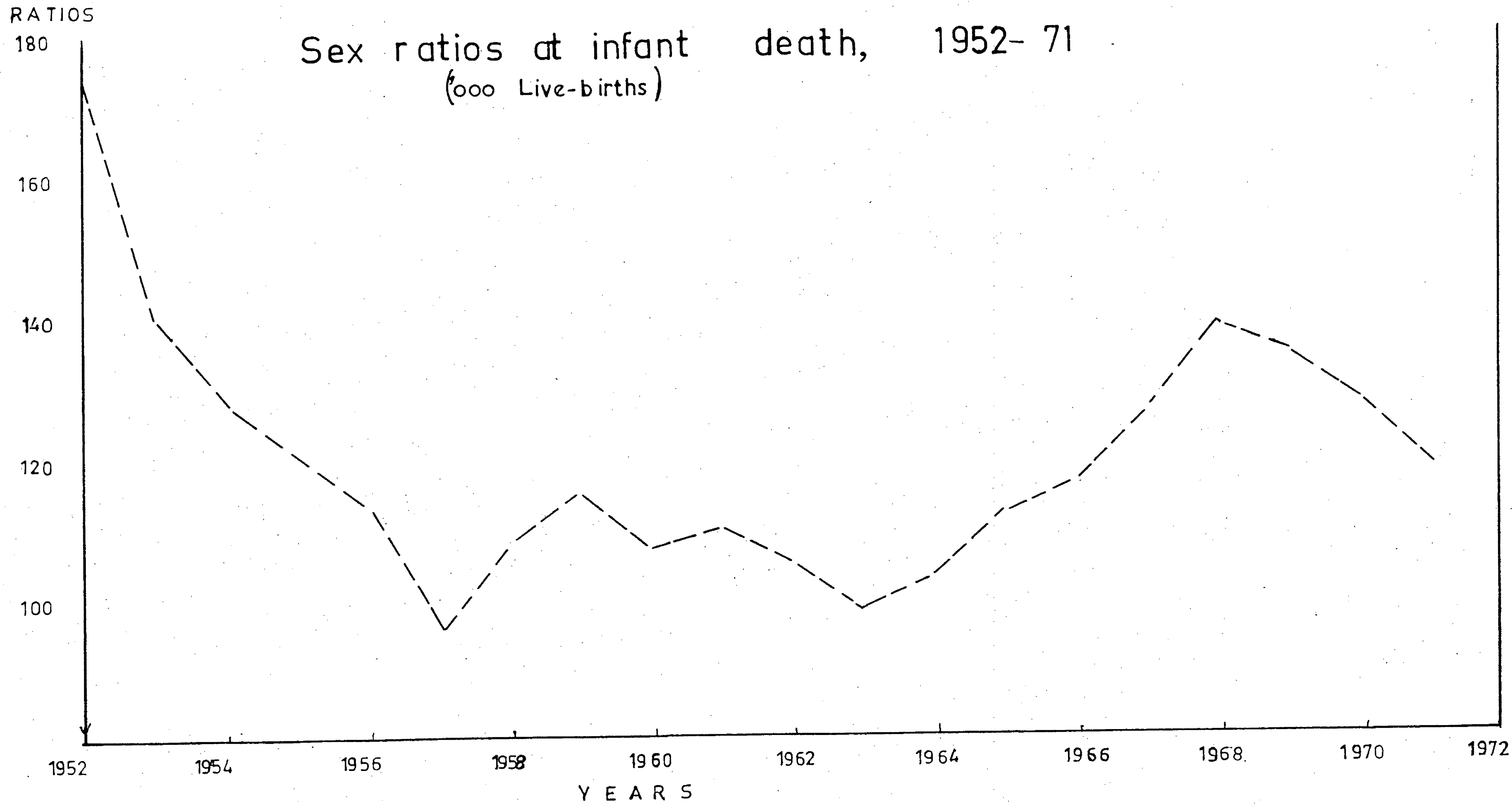
Sex Ratios at Infant Death by Year of Birth Based on Five-Year Moving Average Data for the Study Area. ('00 females)

Mid - Year of Five-Year Average	Sex Ratio at Infant Death ('00 females)
1952	174
1953	140
1954	128
1955	120
1956	113
1957	95
1958	108
1959	115
1960	107
1961	110
1962	105
1963	98
1964	103
1965	112
1966	116
1967	126
1968	138
1969	134
1970	127
1971	118

Source : Pregnancy History Data, 1974. Cape Coast Project.

Figure 4.4

Sex ratios at infant death, 1952- 71
('000 Live-births)



Source: Pregnancy History Data, 1974. Cape Coast Project

Table 4.13

Infant Mortality Rates for Both Sexes According to Size and Location of Study Village. Moving Average Data : 1952-70.

Mid - Year of Five-Year Average	Infant Mortality Rate ('000 live-births)		
	Group 1	Group 2	Group 3
1952	85	135	113
1953	83	124	103
1954	86	115	69
1955	86	107	65
1956	92	101	52
1957	101	89	65
1958	101	79	59
1959	109	87	70
1960	105	86	70
1961	99	83	73
1962	101	88	58
1963	104	89	62
1964	106	90	67
1965	102	88	66
1966	100	84	65
1967	95	80	69
1968	93	78	76
1969	89	66	78
1979	100	73	76

Group 1 : Mpohor, banso, Dominase, Ayiem, Nsuaem;
Group 2 : Asankragwa;
Group 3 : Enchi and Kakasi;

Source : Pregnancy History Data, 1974. Cape Coast Project.

one settlements show under-reporting in the early years. The group three settlements reveal under-reporting throughout the study period. This possible under-reporting of deaths may be the result of memory decay among older women. The group two settlement, Asankrangwa, on the other hand, show reasonable rates, ranging from 135 in 1952 and 124 in 1953 to 66 per thousand live-births in 1969. The rates in-between these two extremes fluctuate from year to year, though not as widely as the unsmoothed rates. The rates are lower than expected for the area. This could be the real situation in that Asankrangwa is the only settlement in the area that has a hospital a secondary school and a population of more than 5,000 people; and in Ghana the level of infant mortality has been found generally to be inversely related to the level of urbanisation (Gaisie 1976:111).

The rates for Asankrangwa can roughly be divided into two periods. The first period prior to 1957, have infant mortality rates exceeding 100 per thousand live-births, while the second period, from 1957 to 1970, has rates of about 90 or less deaths per thousand live-births. This does not necessarily mean that infant mortality in the town has declined over these two periods, but it points to possible changes in infant deaths in the town. This situation of possible changes in infant deaths in Asankrangwa may be the same for the other areas but which are obscured by under-reporting and other errors.

4.5.1 Feeney's Method For Calculating Infant Mortality Rates.

Given in Table 4.14 are the infant mortality rates derived from the the proportion of children dead out of the total born to women in the 20-24, 25-29...45-49 age groups in the 1974 and 1975 surveys using Feeney's (1976) method. The rates from the 1974 survey data are greatly affected by age mis-statement, and show the preference for digits ending in zero among

Table 4.14

Infant Mortality Rates from Child Survivorship Ratios (Feeney's Method) based on the 1975 and 1975 Surveys. Study Area. ('000 live-births)

1974 Survey				1975 Survey			
	Infant Mortality Rate				Infant Mortality Rate		
Years-Prior-to-Survey	Total	Male	Female	Years-Prior-to-Survey	Total	Male	Female
2.6	127	131	122	2.6	107	127	87
4.5	91	97	85	4.5	102	109	95
6.7	96	95	96	6.7	105	97	113
9.3	82	80	84	9.3	111	116	105
12.3	100	110	91	12.4	117	107	99
15.5	88	89	87	15.6	105	112	98

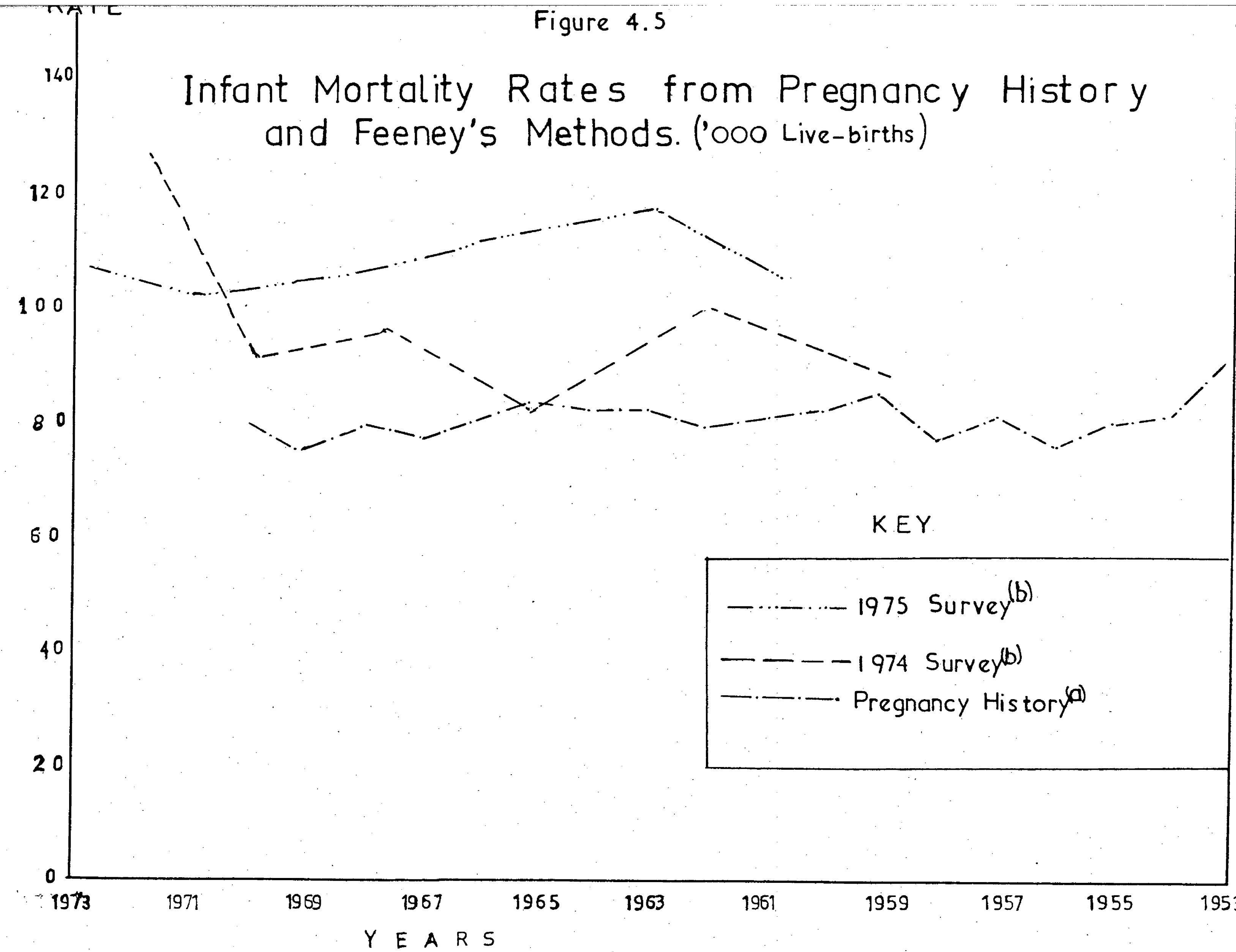
Source: Jain (1978) p 113

females in the area. They also show how the method can be insensitive to age mis-reporting. The 1975 data, on the other hand, show some change in infant deaths between 1963 and 1971. The rate for the period 2.6 years before the survey may have been increased by age mis-reporting among the 25-29 age group and thus leading to a reduction in the level of infant mortality occurring in the period 4.6 years before the survey.. In Figure 4.5, the infant mortality rates from the pregnancy history method are compared with those from Feeney's method. The pregnancy history rates for the total area are the lowest except in 1965. The 1975 data have the highest rates with the exception of 1971. In general Feeney's method give higher infant death rates than the pregnancy history data. The 2.6 years prior-to-the-survey rate, for example, is about 25 per cent higher than the rate for the last five years from the pregnancy history data.

Infant mortality rates from pregnancy history data, according to Bogue and Bogue (1970:152-154), are under-reported by about 25 to 50 percent. This must be qualified in that the level of under-reporting may vary in place and time. It is possible that earlier deaths can be under-reported by about 50 per cent or more and can be less in later periods. For the area 20, it was observed in Chapter Three (Section 3.3.6) that childhood mortality in the most recent period is under-reported by about 20 per cent as compared to the estimates derived for the area. Using this 20 per cent under-reporting, the infant mortality rate for the last five years for both sexes was inflated and this came to 96 deaths per thousand live-births, the rate estimated for the area using a model and the registration data (Jain forthcoming). Male and female rates were 103 and 89 deaths per thousand live births respectively. Compared with the registration rate the male rate seem to be under-reported by about 17 per cent while the female rate is under-reported by about 25 per cent. However, if one considers the fact that the over-all male and female deaths were equally reported, then it can

Figure 4.5

Infant Mortality Rates from Pregnancy History and Feeney's Methods. ('000 Live-births)



Sources (a) Pregnancy History Data, 1974. Cape Coast Project.
(b) Jain (1978)

be inferred that the level of under-reporting should be the same for both sexes. That under-reporting differ by sex for the last five years indicate that event misplacement errors occur in the data. Male and female events have been possibly shifted by about 3 and 5 per cent respectively, with the male deaths placed closer to the survey date while the female ones are shifted into the past.

Two important issues arise from this observation. Firstly, the low female infant mortality rate for the last five years prior to the survey does not come from under-reporting only. It stems from a combination of under-reporting of events and event misplacement errors. As a result not much confidence can be put in the infant mortality rates from the pregnancy history data. Secondly, sex differentials in infant mortality from pregnancy history data, where calculated, should be scrutinised for event misplacement errors as well as under-reporting before any conclusions or inferences can be made on the level of sex differentials in infant deaths.

4.6 CHILDHOOD MORTALITY

In Chapter Three, it was indicated that q(5) values suffer less from age mis-statement and event misplacement distortions than any other measure of childhood mortality for the area. This is mainly because most of the age mis-statement in childhood mortality occurs on or around age 2. It is, therefore, felt that q(5) can be a better estimate of childhood mortality. In this section q(5) values from the moving average procedure are presented for cross-sectional and birth cohort populations (Table 4.15).

No definite trend in childhood mortality can be obtained from either the cross-sectional or the birth cohort data. The rates range from 121 to 145 and 128 to 145 for the cohort and cross-section populations

Table 4.15

Probabilities of Dying from Birth to Exact Age 5 [q(5)] by Sex for Birth Cohort and Cross-Sectional Populations Based on the Moving Average Procedure. Study Area : 1952-70. ('000 population)

Mid - Year of Five-Year Average	Birth Cohort			Cross-Section			
	Probabilities of dying between birth and exact age 5						
(Year of Birth)	Total	Male	Female	Year of Death	Total	Male	Female
1952	145	179	114	1956	133	142	125
1953	135	158	115	1957	140	145	136
1954	122	137	109	1958	138	149	127
1955	123	138	109	1959	145	157	132
1956	121	136	106	1960	145	152	137
1957	130	137	124	1961	143	152	134
1958	133	138	127	1962	139	145	133
1959	140	152	128	1963	141	144	139
1960	137	143	130	1964	141	146	136
1961	135	140	130	1965	139	146	131
1962	130	134	126	1966	134	142	126
1963	126	129	122	1967	128	139	117
1964	130	131	129	1968	132	144	119
1965	129	134	125	1969	131	139	122
1966	126	133	119	1970	138	145	132
Minimum	121	129	109	-	128	139	117
Maximum	145	179	129	-	145	157	139

Source : Pregnancy History Data, 1974. Cape Coast Project.

respectively. Like the infant mortality data, it was felt that the reported q(5) rates were low for such a rural community in Ghana. Estimates for the Western Region indicate that q(5) exceeds 150 deaths per thousand population. On the assumption that the q(5) values may be under-reported by the same margin as the infant mortality data, the rate for the last five years preceding the survey was increased by 20 per cent. The inflated data coincidentally came to the same level as the estimated rate for the area from the registration data. These were 174 and 159 for males and females respectively. For the females this rate is the same as the one obtained from Brass' and Trussell's techniques based on the proportion of children dead out of those ever born to females aged 30-34 (Table 4.16). The male rate from the last two techniques were far under-reported. The plausible q(5) value accepted for the area in the last five years prior to the survey, are 174 for males and 159 for females.

Also indicated in Table 4.16 is the relationship between q(1) and q(5) values for the various observed and estimated rates. The q(1) values from the Brass' and Trussell's techniques look inflated. This factor is well brought out in the males data where the proportion of infant deaths out of the total dead among the 0 to 5 population exceed unity. The female proportions of 87 and 84 per cent from the Brass' and Trussell techniques respectively are equally high for that level of mortality. These high ratios of q(1) to q(5) values point to the possible inflation of the q(5) rates, a feature found to be associated with the method (McDonald 1976:61-62). Using the relationship between q(1) and q(5), $_4q_1$ can be derived. The probability of surviving from birth to exact age 5 can be separated into the probabilities of surviving between birth and exact age 1 and between exact ages 1 and 4. This can be expressed as $_5p_o = {_1p_o}({_4q_1})$, and can be re-written as $_5q_o = 1 - (1 - (1-{_1q_o})\ (1-{_4q_1})$. Since $_5q_o$ and $_1q_o$ known, $_4q_1$ can be obtained by solving the equation. Using the $_1q_o$ and $_5q_o$

Table 4.16

Childhood Mortality Rates by Sex
for the Study Area from Various Sources
1974-7. ('000 population)

	Male			Female		
Measure	Q(1)	Q(5)	Q(1)/Q(5)	Q(1)	Q(5)	Q(1)/Q(5)
			('000 population)			
Smoothed	88	145	.61	72	132	.54
Registration	103	174	.59	89	159	.56
Brass	163	152	1.07	139	160	.87
Trussell(West)	167	147	1.14	132	157	.84
Sullivan(West)	NA	141	NA	NA	150	NA

NA = Not Available

Source : Pregnancy History Data, 1974. Cape Coast Project.

from the registration system $_4q_1$ values for males and females were calculated. The derived $_4q_1$ rates are 79 and 77 per thousand population for males and females respectively. It can be inferred from these rates that the probability of dying between ages 1 and 4 is as high as infant mortality in the area, especially among females.

4.7 SUMMARY

The five-year moving average procedure was used to redistribute the erratic distributions of female population, births and deaths up to age 5 in the original data. The smoothed data were then used in calculating fertility and childhood mortality rates.

The fertility rates obtained from the procedure were considerably better distributed than those derived from the ungraduated data. These graduated rates were then inflated on the basis of under-reporting observed in the data and in comparison with the adjusted rates from the registration system. The five-year rates from the Lexis diagram (Table 3.5) were also adjusted with the distribution of first births as suggested by Brass (1975). This adjustment procedure helped to re-distribute the births to some of the age cohorts; but the rise and fall in fertility over the last fifteen years prior to the survey (see section 3.2.5.5) remained. It was inferred from this observation that the distribution of first births was not adequate for correcting event misplacement errors. The inflated rates from the moving averages were therefore accepted as the plausible fertility rates for the area. It was observed that the level of fertility has not changed much over the last fifteen years before the survey. Fertility is still high with a total fertility rate of between 6 and 7 per woman among the 15-49 age group. There is, however, a 'suspected' change in the pattern of age-specific fertility rates. It is a 'suspected' change because under-reporting and date of event mis-reporting errors in the data do not enable one to reach any firm conclusion. One major reason given for this suspected change in the age schedule of fertility is the impact of formal education on age at first marriage and consequently on age at birth of first child. This reason is, however, not confirmed by the age at first marriage data.

Childhood mortality rates from the data show a high but declining trend. The magnitude of this decline is, however, difficult to measure as a result of under-reporting and event misplacement errors. Both the infant and childhood mortality rates for the last five years preceding the survey were found to be under-reported by about 20 per cent. In addition, the infant mortality rates were suspected of suffering from event misplacement errors. The probability of dying between ages 1 and 4 was calculated using a mathematical relation. This rate was suspected to be as high as infant mortality. In general, female births tended to be better reported than male ones while the reverse was the case with infant deaths.

CHAPTER 5

CONCLUSION

Indirect methods, however effective they may be, have two major flaws. They are (1) inflexible in most of their assumptions; and (2) sensitive to errors. While new frontiers in methodology are geared towards either limiting or introducing more flexible assumptions, not much has been achieved in the attempt to correct errors of omissions or date of event mis-reporting inherent in demographic data. This is mainly because these errors do not occur in any systematic pattern and that they vary from one set of data to the other. No two data sets have the same magnitude of errors.

The pregnancy history method has the advantage of not being based on any assumptions but it suffers very much from errors of mis-reporting and under-reporting of events. One error peculiar to this method is event misplacement. This error involves the reporting of the date of an event close to or further away from the date of survey (Chapter Two). It was with these errors in mind that the objectives for this study were stated twofold as (1) estimating fertility and childhood mortality rates for the study area; and (2) finding out if the pregnancy history data have been well reported for the first objective to be achieved. The reliability of the estimated rates depended on the quality of the data. Have these two objectives been achieved? This last chapter sets out to answer this question by summarising the derived fertility and mortality rates and ratios and other evidences from the study.

The observed levels and patterns of fertility and childhood mortality from the pregnancy history data were, in most cases, either low or distorted when compared with other estimates for the study area, Western Region and total Ghana. Through internal consistency and other checks, it was realised that the low and distorted rates and ratios were not peculiar to the area but are the results of under-reporting, event misplacement and/or age mis-statement errors (Chapter Three). The data, therefore, had to be corrected for some of these errors.

A number of procedures have been suggested for the correction of observed rates from pregnancy history data which are subject to errors. Brass (1971b:10-15, 1975:44-49 and 1977:92-99) has suggested that first order births should be used in adjusting event misplacement errors in pregnancy history data. Potter (1975:34-44 and 1977a:345-347) has, however, demonstrated that the timing of errors in first order births is not the same for other birth orders. This then opens to question the basic assumption upon which Brass' adjustment procedure is based: that "... errors in the reporting of first order births in the recent period bears a consistent relation to errors in the rest of the data." (Brass 1975:49). The rational for this assumption is difficult to accept. In Chapter Four, the single-year data were smoothed using the moving average procedure. The derived data were then used in calculating age-specific fertility rates. The age-specific rates from five-year groupings were adjusted using the relationship between first births of the recent period and total births to various age cohorts as suggested by Brass (1975:44-49). The results did not improve the quality of the data in terms of the rise and fall in the rates over the last 15 years prior to the survey, a feature found to be associated with pregnancy history data sufferring from event misplacement errors. The total fertility rates from the smoothed data were then inflated (where necessary) for under-reporting after comparing them with similar rates obtained from registration system. A summary of the results from these calculations are shown in Table 5.1.

The levels, trends and pattens of fertility derived from the smoothing and adjustment procedures were considered plausible in most cases because they closely followed similar parameters obtained from the registration data or other independent sources for the Western region of Ghana. Fertility in the area has been high and fairly constant over the last 15 years prior to the survey, though not as high as other <u>Akan</u> areas.The high incidence of primary and secondary sterility seem to be the major reason for this low level of fertility. Differentials in age at first marriage do not seem to be a major factor in this because age at first marriage is as low as in other areas of the country.

Childhood mortality rates posed some problems. The infant mortality rates in particular were considered to be implausible and therefore the estimated rate from the registration data was taken as that for the area. The rates from Feeney's method provided better rates than the pregnancy history data. Child mortality up to exact age 5, especially among females, was reasonable and the adjusted rate for 1969-73 was the same as those observed from Brass' and Trussell's techniques (Table 5.1). This was taken as a confirmation of Potter's (1977a:352) suggestion that in the case of childhood mortality q(2) and q(5) should be calculated instead of q(1). Both the q(1) and q(5) rates were under-reported by about 20 per cent for both sexes. In the case of infant deaths the data for the two sexes were affected by event misplacement errors.

Table 5.1

Summary of Vital Rates Estimated for the Study Area

Fertility		
Measure	Year	Rate
Total Fertility Rate (15-49)	1971	5.6
Mean Children Ever-born (50+)	1974	5.2
Per cent aged 50+ Childless	1974	5.4 %
Per cent aged 30+ Ever-Married	1974	99 %
Sex Ratio at Birth ('00 females)	1971	103

Childhood Mortality ('000 population)					
		Q(1)		Q(5)	
Sources	Year	Male	Female	Male	Female
Pregnancy History	1970	88	72	145	132
Registration (adjusted)	1974-7	103	89	174	159
Trussell	1974	167	132	147	157
Brass	1974	163	139	152	160
Feeney	1972-77	127	87	NA	NA
Sex Ratio at Infant Death	1971	118			

NA = Not Available

Source : Pregnancy History Data, 1974. Cape Coast Project.

It must be remembered that some of the observed and estimated levels, trends and patterns of fertility and childhood mortality can arise as a result of the small number of women covered in the survey and not due to any errors. As much as possible, studies of this nature should cover thousands and not hundreds of women.

A few observations are also worth pointing out. Firstly, the calculation of age-specific fertility rates should not extend too far into the past. The last fifteen years prior to the survey date is good enough. Beyond that the rates tend to be distorted showing a tendency among interviewers and/or respondents to push earlier events further into the past and later ones closer to the survey date. Perhaps Potter's (1977a:364) suggestion that interviewing in pregnancy history should start with the latest to the earliest event needs to be given serious consideration.

Secondly, the lower and upper age limits used in the study of fertility should be low and high enough to get women in the 15-19 and 45-49 age groups respectively in the last five years prior to the survey. This solves the problem of having to adjust the data for these two age groups as was done by Bogue and Bogue (1970:138-139). Thirdly, very little is so far known about the relationship between age mis-statement and event misplacement errors in pregnancy history data. As far as we known, these two errors may interact or act singly to give rise to 'older' or 'younger' fertility schedules when they occur. Further research is needed to bring out the relationship between the two errors (if any).

Fourthly, it is suggested that other methods should be used in deriving infant mortality rates to supplement those obtained from pregnancy history data. At the moment, Feeney's method using the proportion of children dead out of those ever-born to women in the various five-year age group seem to be a promising method for such an exercise.

Lastly, it was felt that the pregnancy history data from the area was not well reported for direct fertility and childhood mortality change to be measured. As a result the data had to be adjusted in various ways before any rates could be derived. Nevertheless, the data gave a fair idea about the level and pattern of fertility and childhood mortality in the area.

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Appendix A1

PREGNANCY FORM B
CONFIDENTIAL

DEMOGRAPHIC SURVEY 1974

DEPARTMENT OF SOCIOLOGY
UNIVERSITY OF CAPE COAST

Area ________ House No. ________ Name of the head of household ________ Interviewer ________ Date interviewed ________

Line No. from Form A ________ Name of respondent ________ Time begun ________ Time ended ________

RECORD OF PREGNANCIES	Total	Male	Female
1. How many live born children have you had altogether? (If none enter *none* and skip to Q.6)			
2. How many of these children are alive now? List in column (1) name, (2) date of birth, (3) age, (4) sex, and check column (6) for each child.			
3. How many children do you have who are living with someone else? (If none, enter *none*; If some, list in col. (1), (2), (3), (4). Are they living apart? Check (7). Adopted out? Check (8)).			
4. Are all these children really yours, or are they some other women's children whom you may have adopted? (If adopted, enter date in column (10)).	All mine ________ Adopted ________		
5. Have you had any children who died since birth? How many? (If no, enter *none*. If yes, list in column (1), (2), (3), (4) and enter dates of death in column (9)).	Total	Male	Female
6. Have you had any pregnancies that ended in stillbirth, miscarriage or abortion? How many? When did these pregnancies end? (If no, enter *none*. If yes, enter Loss in column (1) date in column (2) and check column (11), (12), or (13)).		Note: Go over to the pregnancy list.	
7. Are you pregnant now? Yes ________ No ________ If Yes, months ________	NOTE: Enter order of pregnancies in col. 5 from first oldest to last youngest		

NAME OF CHILD or enter Loss if stillborn etc.	Date of birth or end of pregnancy	Age at last birthday	Sex	Pregnancy No.	LIVE BIRTHS: Alive now	LIVE BIRTHS: Living apart	LIVE BIRTHS: Adopted out	LIVE BIRTHS: Deceased [date]	Taken in or adopted [date]	PREGNANCY LOSS: Stillborn	PREGNANCY LOSS: Mis-carriage	PREGNANCY LOSS: Abortion
1	2	3	4	5	6	7	8	9	10	11	12	13

8. **(If there is an interval of 2 or more years between pregnancies ask this question).**

There is long interval between ________ and ________ Did we miss any? Yes ________ No ________

If yes, was it a live birth? If yes, list in record. If no, why didn't you become pregnant for such a long time? (Check answer but do not mention)

Husband away ________, Not living with man ________, Did something to avoid pregnancy ________, Other (specify) ________

Appendix A2

Coding Sheet for Pregnancy History Data

DEMOGRAPHIC SURVEY, 1974
CARD NUMBERS 5 & 6
RECORD OF PREGNANCIES

Coder ______________

Date ______________

Item	Area	House number
Code		
Card column	1	2-4

No.	Item		Card column	Pregnancies of mothers											
3	Number of households		5-6												
4	Household number		7-8												
5	Household type		9												
6	Line number of mother		10-11												
7	Number of live born children	Total	12-13												
8		Male	14												
9		Female	15												
10	Number of children adopted in		16												
11	Present pregnancy status		17												
12	Number of pregnancies		18-19												
13	Card number		20	5	6	5	6	5	6	5	6	5	6	5	6
14	I & VII Pregnancy	Pregnancy number	21-22												
15		Status of child	23												
16		Month of birth	24-25												
17		Year of birth	26-27												
18		Sex of child	28												
19		Year deceased	29-30												
20	II & VIII Pregnancy	Pregnancy number	31-32												
21		Status of child	33												
22		Month of birth	34-35												
23		Year of birth	36-37												
24		Sex of child	38												
25		Year deceased	39-40												
26	III & IX Pregnancy	Pregnancy number	41-42												
27		Status of child	43												
28		Month of birth	44-45												
29		Year of birth	46-47												
30		Sex of child	48												
31		Year deceased	49-50												
32	IV & X Pregnancy	Pregnancy number	51-52												
33		Status of child	53												
34		Month of birth	54-55												
35		Year of birth	56-57												
36		Sex of child	58												
37		Year deceased	59-60												
38	V & XI Pregnancy	Pregnancy number	61-62												
39		Status of child	63												
40		Month of birth	64-65												
41		Year of birth	66-67												
42		Sex of child	68												
43		Year deceased	69-70												
44	VI & XII Pregnancy	Pregnancy number	71-72												
45		Status of child	73												
46		Month of birth	74-75												
47		Year of birth	76-77												
48		Sex of child	78												
49		Year deceased	79-80												

Appendix A3

Number of Females by Age: 1931-73. Study Area.

Age of Female

Number of Women

Year	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
1931	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	41	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	36	41	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	62	36	41	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	32	62	36	41	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	137	32	62	36	41	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1937	28	137	32	62	36	41	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1938	97	28	137	32	62	36	41	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1939	38	97	28	137	32	62	36	41	56	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	58	38	97	28	137	32	62	36	41	56	0	0	0	0	0	0	0	0	0	0	0	0
1941	163	58	38	97	28	137	32	62	36	41	56	0	0	0	0	0	0	0	0	0	0	0
1942	52	163	58	38	97	28	137	32	62	36	41	56	0	0	0	0	0	0	0	0	0	0
1943	56	52	163	58	38	97	28	137	32	62	36	41	56	0	0	0	0	0	0	0	0	0
1944	90	56	52	163	58	38	97	28	137	32	62	36	41	56	0	0	0	0	0	0	0	0
1945	37	90	56	52	163	58	38	97	28	137	32	62	36	41	56	0	0	0	0	0	0	0
1946	196	37	90	56	52	163	58	38	97	28	137	32	62	36	41	56	0	0	0	0	0	0
1947	56	196	37	90	56	52	163	58	38	97	28	137	32	62	36	41	56	0	0	0	0	0
1948	132	56	196	37	90	56	52	163	58	38	97	28	137	32	62	36	41	56	0	0	0	0
1949	66	132	56	196	37	90	56	52	163	58	38	97	28	137	32	62	36	41	56	0	0	0
1950	119	66	132	56	196	37	90	56	52	163	58	38	97	28	137	32	62	36	41	56	0	0
1951	209	119	66	132	56	196	37	90	56	52	163	58	38	97	28	137	32	62	36	41	56	0
1952	86	209	119	66	132	56	196	37	90	56	52	163	58	38	97	28	137	32	62	36	41	56
1953	77	86	209	119	66	132	56	196	37	90	56	52	163	58	38	97	28	137	32	62	36	41
1954	129	77	86	209	119	66	132	56	196	37	90	56	52	163	58	38	97	28	137	32	62	36
1955	47	129	77	86	209	119	66	132	56	196	37	90	56	52	163	58	38	97	28	137	32	62
1956	267	47	129	77	86	209	119	66	132	56	196	37	90	56	52	163	58	38	97	28	137	32
1957	78	267	47	129	77	86	209	119	66	132	56	196	37	90	56	52	163	58	38	97	28	137
1958	201	78	267	47	129	77	86	209	119	66	132	56	196	37	90	56	52	163	58	38	97	28
1959	153	201	78	267	47	129	77	86	209	119	66	132	56	196	37	90	56	52	163	58	38	97
1960	165	153	201	78	267	47	129	77	86	209	119	66	132	56	196	37	90	56	52	163	58	38
1961	223	165	153	201	78	267	47	129	77	86	209	119	66	132	56	196	37	90	56	52	163	58
1962	191	223	165	153	201	78	267	47	129	77	86	209	119	66	132	56	196	37	90	56	52	163
1963	139	191	223	165	153	201	78	267	47	129	77	86	209	119	66	132	56	196	37	90	56	52
1964	195	139	191	223	165	153	201	78	267	47	129	77	86	209	119	66	132	56	196	37	90	56
1965	166	195	139	191	223	165	153	201	78	267	47	129	77	86	209	119	66	132	56	196	37	90
1966	258	166	195	139	191	223	165	153	201	78	267	47	129	77	86	209	119	66	132	56	196	37
1967	193	258	166	195	139	191	223	165	153	201	78	267	47	129	77	86	209	119	66	132	56	196
1968	272	193	258	166	195	139	191	223	165	153	201	78	267	47	129	77	86	209	119	66	132	56
1969	223	272	193	258	166	195	139	191	223	165	153	201	78	267	47	129	77	86	209	119	66	132
1970	228	223	272	193	258	166	195	139	191	223	165	153	201	78	267	47	129	77	86	209	119	66
1971	232	228	223	272	193	258	166	195	139	191	223	165	153	201	78	267	47	129	77	86	209	119
1972	241	232	228	223	272	193	258	166	195	139	191	223	165	153	201	78	267	47	129	77	86	209
1973	239	241	232	228	223	272	193	258	166	195	139	191	223	165	153	201	78	267	47	129	77	86

Appendix A3

Number of Females by Age; 1931-73. Study Area.

Year	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	Total
	Number of Women																					
1931	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	56
1932	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	97
1933	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	133
1934	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	195
1935	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	227
1936	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	364
1937	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	392
1938	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	489
1939	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	527
1940	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	585
1941	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	748
1942	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	800
1943	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	856
1944	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	946
1945	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	983
1946	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1179
1947	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1235
1948	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1367
1949	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1433
1950	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1552
1951	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1761
1952	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1847
1953	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1924
1954	41	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2053
1955	36	41	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2100
1956	62	36	41	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2367
1957	32	62	36	41	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2445
1958	137	32	62	36	41	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2646
1959	28	137	32	62	36	41	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2799
1960	97	28	137	32	62	36	41	56	0	0	0	0	0	0	0	0	0	0	0	0	0	2964
1961	38	97	28	137	32	62	36	41	56	0	0	0	0	0	0	0	0	0	0	0	0	3187
1962	58	38	97	28	137	32	62	36	41	56	0	0	0	0	0	0	0	0	0	0	0	3378
1963	163	58	38	97	28	137	32	62	36	41	56	0	0	0	0	0	0	0	0	0	0	3517
1964	52	163	58	38	97	28	137	32	62	36	41	56	0	0	0	0	0	0	0	0	0	3712
1965	56	52	163	58	38	97	28	137	32	62	36	41	56	0	0	0	0	0	0	0	0	3878
1966	90	56	52	163	58	38	97	28	137	32	62	36	41	56	0	0	0	0	0	0	0	4136
1967	37	90	56	52	163	58	38	97	28	137	32	62	36	41	56	0	0	0	0	0	0	4329
1968	196	37	90	56	52	163	58	38	97	28	137	32	62	36	41	56	0	0	0	0	0	4601
1969	56	196	37	90	56	52	163	58	38	97	28	137	32	62	36	41	56	0	0	0	0	4824
1970	132	56	196	37	90	55	52	163	58	38	37	28	137	32	62	36	41	56	0	0	0	5052
1971	66	132	56	196	37	90	56	52	163	58	38	97	28	137	32	62	36	41	56	0	0	5284
1972	119	66	132	56	196	37	90	56	52	163	58	38	97	28	137	32	62	36	41	56	0	5525
1973	209	119	66	132	56	196	37	90	56	52	163	58	38	97	28	137	32	62	36	41	56	5764

Appendix A4

All Births by Age of Female: 1931-73. Study Area.

Year	Age of Female: 13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Reported Births																						
1931	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	1	2	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	1	2	1	6	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	1	0	3	5	2	11	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
1937	0	4	1	6	4	5	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1938	3	2	3	5	7	8	7	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1939	1	4	0	17	4	6	10	9	13	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	1	2	3	11	6	16	10	8	12	0	0	0	0	0	0	0	0	0	0	0	0
1941	3	0	1	11	2	15	7	9	8	11	10	0	0	0	0	0	0	0	0	0	0	0
1942	1	5	0	1	10	5	9	7	7	7	10	15	0	0	0	0	0	0	0	0	0	0
1943	1	2	15	5	2	17	5	37	5	17	14	5	13	0	0	0	0	0	0	0	0	0
1944	1	1	3	19	8	4	19	5	21	10	8	5	16	12	0	0	0	0	0	0	0	0
1945	0	0	5	6	19	13	4	21	6	29	9	17	8	10	14	0	0	0	0	0	0	0
1946	3	1	4	6	5	26	12	5	24	11	30	8	16	14	8	13	0	0	0	0	0	0
1947	1	7	0	7	7	10	32	13	8	20	3	33	7	13	7	9	13	0	0	0	0	0
1948	4	1	13	4	15	8	7	33	14	10	25	12	27	8	15	9	10	12	0	0	0	0
1949	0	4	5	16	5	12	11	13	35	9	4	22	9	36	8	19	8	10	19	0	0	0
1950	1	0	12	5	12	4	17	5	10	25	11	13	28	7	28	6	12	9	10	11	0	0
1951	5	4	3	10	3	33	6	15	12	9	37	10	6	22	7	23	2	10	5	8	16	0
1952	1	5	6	4	17	11	22	5	17	13	10	29	17	8	22	3	18	1	19	6	13	5
1953	0	3	16	12	9	25	10	39	11	26	11	13	38	9	4	24	5	38	6	9	7	6
1954	0	4	7	18	16	12	27	12	41	7	21	19	7	36	12	4	16	8	24	5	6	6
1955	2	5	7	12	27	20	14	29	18	42	10	27	11	10	44	7	8	13	4	20	6	15
1956	3	1	11	12	14	37	25	23	39	15	43	7	26	18	8	38	18	8	29	5	24	6
1957	1	11	6	20	15	17	48	24	19	32	15	38	12	21	9	11	38	9	6	19	3	11
1958	4	3	13	9	22	15	26	40	29	20	47	15	51	7	22	18	14	29	13	6	17	1
1959	2	4	2	32	8	26	23	22	52	30	19	43	13	40	10	[illegible]	13	11	35	10	8	24
1960	5	5	11	6	38	12	24	19	17	44	29	17	32	10	37	8	23	16	12	36	11	4
1961	2	4	7	14	9	45	10	36	18	22	46	32	16	29	18	43	8	24	15	13	34	12
1962	1	7	7	15	32	14	57	12	25	16	25	35	24	22	35	11	46	5	22	9	9	28
1963	2	4	19	18	24	39	15	72	12	40	20	31	53	38	18	37	16	51	8	27	14	13
1964	2	4	5	15	16	22	38	18	81	11	28	24	17	48	28	18	35	11	43	12	16	14
1965	2	5	3	12	30	26	33	44	24	72	14	39	16	30	44	25	19	31	20	51	6	26
1966	3	2	16	13	19	37	34	36	52	17	81	12	38	22	19	55	27	17	23	8	36	7
1967	0	5	6	10	22	28	35	36	36	37	19	73	16	39	21	27	43	22	21	36	22	34
1968	0	3	11	14	26	24	43	57	50	33	60	26	72	11	28	18	16	56	31	19	27	7
1969	2	5	7	23	27	30	25	36	44	42	49	48	26	68	12	35	24	23	41	28	13	26
1970	0	1	8	11	40	37	49	26	42	49	45	38	53	23	65	11	25	12	21	49	19	10
1971	0	1	6	24	32	43	33	33	30	49	61	50	44	48	20	73	9	37	13	12	39	24
1972	0	2	4	16	25	30	58	28	38	26	53	52	40	33	41	15	48	7	28	15	17	31
1973	0	0	5	9	21	36	37	72	37	45	29	35	57	36	51	39	14	62	10	24	17	21
Total	60	123	257	454	613	774	856	916	903	859	896	843	809	728	655	624	523	532	478	433	390	331

Appendix A4

All Births by Age of Female: 1931-73. Study Area.

Age of Female

Year	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	Total
										Reported Births												
1931	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
1934	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
1935	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18
1936	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23
1937	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28
1938	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50
1939	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	64
1940	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	69
1941	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	77
1942	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	77
1943	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	138
1944	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	132
1945	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	161
1946	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	186
1947	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	190
1948	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	227
1949	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	245
1950	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	226
1951	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	246
1952	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	252
1953	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	335
1954	7	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	324
1955	8	9	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	376
1956	11	4	4	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	437
1957	7	8	5	4	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	416
1958	20	2	13	5	8	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	480
1959	2	21	8	9	3	3	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	504
1960	17	5	15	3	13	5	5	7	0	0	0	0	0	0	0	0	0	0	0	0	0	486
1961	8	7	3	20	4	3	6	4	7	0	0	0	0	0	0	0	0	0	0	0	0	519
1962	13	8	21	1	17	2	4	3	1	7	0	0	0	0	0	0	0	0	0	0	0	534
1963	29	17	6	16	3	16	1	3	2	2	4	0	0	0	0	0	0	0	0	0	0	670
1964	12	32	14	4	19	3	17	1	4	1	4	8	0	0	0	0	0	0	0	0	0	625
1965	10	10	27	10	6	16	0	14	2	2	1	3	3	0	0	0	0	0	0	0	0	676
1966	17	7	6	26	10	3	13	2	13	1	4	1	0	5	0	0	0	0	0	0	0	682
1967	6	16	11	9	21	9	9	9	0	6	1	0	1	0	3	0	0	0	0	0	0	689
1968	45	9	21	10	8	18	9	2	13	2	7	0	1	0	0	2	0	0	0	0	0	779
1969	19	36	6	24	12	9	15	6	3	4	0	11	0	3	1	0	4	0	0	0	0	787
1970	23	12	31	4	11	7	7	16	6	2	4	0	7	0	0	0	1	2	0	0	0	767
1971	12	23	12	23	7	13	9	8	10	3	5	4	1	6	0	0	0	1	0	0	0	823
1972	14	11	14	8	25	3	7	5	5	11	3	3	0	1	2	0	0	0	0	0	0	719
1973	42	22	14	22	7	13	5	11	2	3	7	2	2	2	1	3	0	1	0	0	2	818
Total	336	268	219	206	181	134	113	91	68	44	40	12	15	17	7	5	5	4	0	0	2	1456

Appendix A5

First Order Births by Age of Female: 1931-73. Study Area.

Age of Female

Year	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
								Reported Births														
1931	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	1	2	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	1	1	1	5	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	1	0	3	3	1	7	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
1937	0	3	0	6	2	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1938	3	2	3	5	5	5	2	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1939	1	3	0	14	4	2	4	4	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	1	1	2	7	3	6	3	4	2	0	0	0	0	0	0	0	0	0	0	0	0
1941	3	0	0	7	2	9	3	4	2	3	1	0	0	0	0	0	0	0	0	0	0	0
1942	1	4	0	1	7	3	3	2	1	1	2	1	0	0	0	0	0	0	0	0	0	0
1943	1	1	13	5	2	13	2	21	3	2	1	3	1	0	0	0	0	0	0	0	0	0
1944	1	0	3	12	7	2	8	1	8	2	1	0	3	2	0	0	0	0	0	0	0	0
1945	0	0	4	5	13	8	2	6	4	7	2	2	0	2	2	0	0	0	0	0	0	0
1946	3	1	4	2	5	7	7	4	7	4	4	2	6	1	0	0	0	0	0	0	0	0
1947	1	6	0	6	2	4	13	5	5	6	0	6	1	1	1	1	0	0	0	0	0	0
1948	4	1	11	3	9	5	4	15	4	4	2	1	6	0	3	1	1	3	0	0	0	0
1949	0	4	4	11	5	8	7	6	9	1	2	4	4	8	1	4	1	0	1	0	0	0
1950	1	0	9	5	8	4	6	2	5	2	2	1	4	0	1	0	0	0	0	3	0	0
1951	5	4	3	7	1	18	2	5	4	1	7	2	1	1	0	1	0	0	2	2	0	0
1952	1	4	4	4	9	5	9	3	8	5	1	6	1	1	3	0	0	0	1	0	0	0
1953	0	3	13	9	8	14	7	17	4	9	4	0	12	0	0	2	0	6	0	0	0	1
1954	0	4	5	15	11	6	13	5	11	2	6	5	1	5	1	0	0	0	1	0	0	0
1955	2	5	7	10	15	13	9	13	4	13	3	4	1	0	6	1	2	0	0	0	0	2
1956	3	1	11	9	7	22	12	12	11	2	6	0	3	1	2	1	0	1	1	0	3	0
1957	1	9	5	16	8	11	19	11	2	7	3	10	2	0	0	1	5	1	1	2	0	1
1958	4	3	11	6	16	8	10	16	10	4	9	2	9	0	3	0	2	2	1	0	3	0
1959	2	3	2	21	4	14	9	6	12	4	3	6	1	5	0	0	1	2	2	0	1	0
1960	3	4	10	5	22	9	8	4	5	14	6	0	5	1	4	0	3	1	0	0	1	0
1961	2	4	7	12	6	26	4	14	3	6	12	4	1	2	1	6	1	0	0	0	1	1
1962	1	6	4	11	23	8	26	3	4	3	6	2	2	4	0	0	5	0	1	0	0	1
1963	2	4	19	15	16	22	8	28	2	3	2	1	9	2	3	2	1	2	0	0	1	2
1964	2	4	4	13	13	14	10	10	28	2	4	2	1	6	1	0	1	0	2	0	2	1
1965	2	5	2	9	20	16	12	22	9	10	2	4	1	2	3	1	0	1	4	1	0	1
1966	3	2	16	10	17	26	19	13	17	4	12	0	5	0	1	7	1	2	0	0	1	0
1967	0	5	5	9	19	16	20	17	12	9	3	7	0	4	1	0	1	0	0	0	1	1
1968	0	3	8	12	19	12	30	22	18	8	17	4	8	0	3	0	0	3	1	0	0	0
1969	2	4	7	20	21	19	18	18	11	11	9	6	1	4	0	0	1	1	4	2	0	0
1970	0	1	8	10	31	26	28	9	16	17	12	10	8	4	4	2	0	0	0	5	0	0
1971	0	1	6	20	26	29	19	16	9	12	11	7	7	6	0	2	1	0	1	1	1	0
1972	0	2	4	15	21	25	27	11	13	13	15	6	2	3	3	0	2	0	1	0	1	0
1973	0	0	5	9	19	27	20	32	12	7	4	8	13	3	3	3	0	2	0	1	1	0
Total	58	110	225	362	439	458	409	385	282	201	174	116	119	68	50	35	29	27	24	17	17	11

Appendix A5

First Order Births by Age of Female: 1931-73. Study Area.

Age of Female

Year	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	Total
									Reported Births													
1931	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
1934	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
1935	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14
1936	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16
1937	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16
1938	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30
1939	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37
1940	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29
1941	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34
1942	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26
1943	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	68
1944	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50
1945	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57
1946	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57
1947	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	58
1948	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	77
1949	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	80
1950	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	53
1951	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	66
1952	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65
1953	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	109
1954	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	91
1955	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	112
1956	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	109
1957	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	115
1958	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	122
1959	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	102
1960	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	109
1961	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	115
1962	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	113
1963	3	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	150
1964	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	123
1965	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	128
1966	0	0	0	3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	160
1967	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	131
1968	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	171
1969	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	162
1970	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	191
1971	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	175
1972	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	165
1973	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	170
Total	11	6	5	8	4	2	1	1	2	1	0	0	0	0	0	0	0	0	0	0	0	3666

Appendix B1

Indices of Accuracy of Age and Age-sex Reporting in Various Populations of Ghana

Populations	Whipple's Index		Myers' Index		U.N. Secretariat Index Percent contribution			
					Age Ratio Score		Sex Ratio Score	Index
	Male	Female	Male	Female	Male	Female		
Cape Coast Project[a]								
1974	166	187	26	32	24	15	62	63
1975	157	187	24	33	15	18	68	80
1976	156	185	24	32	16	17	67	49
1977	156	189	22	30	18	19	63	52
1970 Ghana Census[b]								
Total Ghana	179	188	28	32	23	29	48	43
Urban Ghana	157	175	21	27	15	23	62	45
Rural Ghana	190	192	31	34	22	27	51	51
W. Region	178	194	28	33	22	24	53	48

Key to Whipple's Index[c]

1.	Highly Accurate Data	Less than 105
2.	Fairly Accurate Data	105 - 109.9
3.	Approximate Data	110 - 124.9
4.	Rough Data	125 - 174.9
5.	Very Rough Data	175 and more

Sources : (a) and (b) Jain (forthcoming)
(c) United Nations (1963) p 20.

Appendix B2

Per Cent of Blended Sum at each Digit and the Value of Myers' Index among various Female Populations of Ghana.

Digit	Cape Coast Project				Ghana 1970 Census			
	1974	1975	1976	1977	Total	Urban	Rural	Western
0	18	19	19	20	20	18	21	21
1	6	7	6	7	6	7	6	6
2	10	9	10	10	10	11	10	10
3	7	7	6	6	7	7	7	7
4	8	8	8	8	8	9	8	8
5	15	15	15	14	14	13	14	14
6	10	9	9	9	10	10	9	9
7	7	7	8	8	6	7	6	6
8	13	13	12	12	12	11	12	12
9	6	7	7	7	7	7	7	7
Total	100	100	100	100	100	100	100	100
Index	26	24	24	22	28	21	31	28

Source: Jain (Forthcoming).

Appendix B3

Sex Ratios in Broad Age Groups for Ghana

Populations	Age Groups				
	0-14	15-44	45-64	65+	Total
Cape Coast Project [a]					
1974	100.8	87.9	71.5	96.1	95.1
1975	103.5	86.5	97.9	91.2	95.0
1976	103.4	86.1	86.7	104.8	94.1
1977	102.3	85.6	91.3	100.8	93.6
Ghana Census					
Total 1960	102.4	97.5	122.1	112.6	102.2
Total 1970	101.3	92.6	110.2	102.3	98.5
Urban 1970	92.6	106.1	113.4	78.9	99.6
Rural 1970	104.8	86.8	109.2	109.2	98.1
W. Region 1970	99.0	104.4	134.2	119.6	104.7
1968 Survey [b]	100.2	82.6	101.0	124.6	94.3

Sources : (a) Jain (forthcoming)
(b) Gaisie (1976) p 19.

Appendix B4

Mean Age of Women at Birth of First to Tenth Order Births

Year of Birth	1	2	3	4	5	6	7	8	9	10
	Mean age at Birth (In Years)									
1948	19.3	21.3	23.5	25.2	24.8	26.3	28.7	-	-	-
1949	20.1	22.3	23.5	24.8	27.2	28.2	28.2	29.1	29.3	30.4
1950	19.1	22.1	25.5	24.6	27.7	26.7	31.2	28.9	31.0	-
1951	19.3	21.0	24.1	25.9	26.8	30.1	29.7	-	32.1	-
1952	19.0	21.8	23.4	27.9	28.3	29.3	29.4	31.0	31.2	-
1953	19.6	22.6	23.9	26.7	27.9	29.1	30.1	30.4	-	-
1954	18.7	21.7	24.8	25.8	28.2	30.3	31.5	31.8	30.7	33.4
1955	19.3	22.3	24.5	25.6	29.5	30.3	31.4	34.7	35.3	36.1
1956	18.9	21.8	24.3	26.1	28.8	30.5	31.8	32.3	33.7	33.8
1957	19.8	21.0	25.0	25.7	27.6	31.0	32.6	33.5	34.0	38.5
1958	19.8	21.8	24.4	27.5	28.3	29.8	33.3	34.5	36.2	37.0
1959	19.8	22.9	23.4	27.4	29.0	29.8	35.2	35.5	31.7	-
1960	19.6	22.9	25.1	26.3	28.8	31.4	35.3	35.9	35.8	34.3
1961	20.3	23.2	24.9	27.3	28.8	31.3	32.3	33.6	37.3	37.6
1962	19.3	21.4	24.8	28.1	30.2	31.5	33.4	36.1	36.3	38.3
1963	19.6	22.3	25.6	27.7	29.8	32.1	32.6	34.1	36.3	41.3
1964	20.0	22.5	25.3	27.8	30.8	31.4	32.7	36.8	38.3	39.3
1965	19.6	22.6	24.3	27.6	29.0	31.9	34.7	35.1	37.3	38.1
1966	19.8	23.4	25.2	27.4	29.6	31.9	33.8	35.8	36.6	41.4
1967	19.5	23.3	25.3	27.5	29.8	31.2	33.0	35.3	36.5	38.9
1968	19.5	22.3	25.8	28.2	30.8	32.2	34.3	34.6	36.7	40.6
1969	19.8	22.2	25.8	28.4	29.8	33.2	34.3	34.8	38.0	39.3
1970	19.8	22.8	25.5	28.3	29.2	32.3	33.3	36.0	36.9	39.3
1971	19.5	22.4	24.9	27.8	29.8	33.2	34.8	36.9	34.4	41.1
1972	19.6	22.9	25.7	27.2	31.7	31.9	33.6	36.7	38.8	39.5
1973	20.0	22.3	25.3	28.1	30.2	32.3	34.1	35.8	39.0	41.3

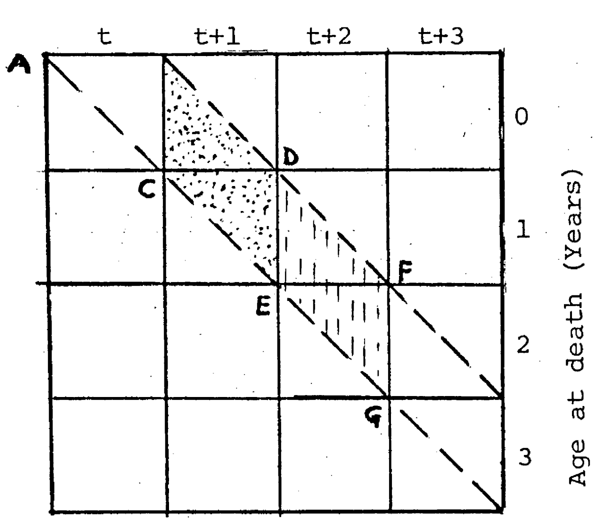
Source: Pregnancy History Data, 1974. Cape Coast Project.

Appendix C

A note on the Calculation of Age at Death in Pregnancy History Data

The subtraction of the date of birth from the date of death in respect of the deceased children in the pregnancy history data results in their age structure giving information on the number of children who died before reaching the exact age 1, exact age 2, etc. These data are identical to the d_x column in a cohort life table where the radix (i.e. l_o) is the reported number of children born in that year. But in many surveys the month of birth and death is unreliable or sometimes not recorded at all. In such a situation the difference of the year of death and the year of birth gives the age of the deceased child as 0 or 1 for those born in year t and died in year t+1, as 1 or 2 for those born in the same year t but died in year t+2 etc. The following Lexis diagram expedites the situation.

Year of death for those born in year t



(i) The children who were born in year t and died in the same year t must have died before completing exact age 1. All these deaths occurred at age 0 and can be represented by area ABC.

(ii) Of those who died in year t+1 but born in year t, some died at central age 0 and some at 1; the deaths occurred in areas BCD and CDE respectively.

(iii) Similarly, of those who died in year t+2 but born in year t, some died at central age 1 (area DEF) and some at age 2 (area EFG).

The subtraction of the year of birth from the year of death gives the deaths which occurred in areas ABC, BCED, DEGF etc. The task then is to split the deaths in the parallelogram (BCED or DEGF) into deaths in two triangles (BCD and CDE or DEF and EFG), and add the deaths in the relevant triangles to obtain deaths experienced by each cohort at ages 0, 1, 2 etc., the equivalent of the d_x column in the life table. Thus the deaths in triangle ABC could be added to deaths in triangle BCD, to obtain the total death before exact age 1 experienced by the cohort born in year t. Similarly the sum of deaths in triangles CDE and DEF will give deaths experienced by the cohort of year t between the exact ages 1 and 2 etc. Having obtained the age structure of deaths in this fashion life table functions based on the real cohort data can be derived directly.

The splitting of the deaths in each of the parallelograms into two triangles as mentioned above can be done with the help of the model life tables.

If f_x denotes the separation factor at age x, d_x the number of deaths between exact age x and x+1, then at a given level of mortality d_o can be split into two triangles ABC and BCD, d_1 into two triangles CDE and DEF etc. as follows:

(i) Deaths in triangle ABC $= (1-f_o)d_o$

" " " BCD $= f_o d_o$

(ii) Deaths in triangle CDE $= (1-f_1)d_1$

" " " DEF $= f_1 d_1$

(iii) Deaths in triangle EFG $= (1-f_2)d_2$

" " " GHI $= f_2 d_2$

and so on.

From (i) and (ii), the proportion of deaths occurring in triangle BCD among total deaths in two triangles BCD and CDE (i.e. in the parallelograms BCED) is equal to

$$\frac{f_o d_o}{f_o d_o + (1-f_1)\ d_1}$$

The proportion of deaths in triangle CDE will be $\dfrac{(1-f_1)\ d_1}{f_o d_o + (1-f_1)\ d_1}$

Similarly the proportion of deaths in triangle DEF to total deaths in parallelogram DEGF will be

$$\frac{f_1 d_1}{f_1 d_1 + (1-f_2)\ d_2}$$, and the

deaths in triangle EFG, the difference of the above from unity.

Thus as a general rule, the proportion of deaths which occurred in year <u>t+x+1</u> to cohort of year <u>t</u> at age x and x+1 can be written as follows.

$$\text{At age } x = \frac{f_x d_x}{f_x d_x + (1-f_{x+1})\, d_{x+1}}$$

$$\text{At age } x+1 = \frac{(1-f_{x+1})\, d_{x+1}}{f_x d_x + (1-f_{x+1})\, d_{x+1}}$$

where x represents the age.

The 'observed' numbers of deaths in parallelograms such as BCED in the pregnancy history data can then be split into two ages based on the above proportions and, as mentioned earlier, the deaths experienced by each cohort before exact age 1, age 2, etc. can be worked out.

For various levels of mortality 13, 14 and 15, and North and West families of life tables we calculated the said proportions for splitting deaths at an 'observed' age in the pregnancy history data and found that these proportions at a given age did not differ between the levels of mortality but differed according to the family of life table selected at the same level. The following table presents these proportions for males and females based on the North and West family of tables at the mortality level of 14. The assumed values of the separation factors were $f_o = .335$, $f_1 = .40$ and f_2, f_3 etc. all equal to 0.5.

Proportion of Deaths in Various Years to Cohort of Year t

Year/Age	North family (Level 14)		West family (Level 14)		Selected Values for Both Sexes
	Male	Female	Male	Female	
Year t					
Age 0	1.00	1.00	1.00	1.00	1.00
Year t+1					
Age 0	.7673	.7584	.7935	.7638	.75
Age 1	.2327	.2416	.2065	.2362	.25
Year t+2					
Age 1	.5682	.5582	.6462	.6410	.56
Age 2	.4318	.4418	.3538	.3590	.44
Year t+3					
Age 2	.5736	.5661	.6045	.6074	.56
Age 3	.4264	.4339	.3955	.3926	.44
Year t+4					
Age 3	.5678	.5639	.5733	.5691	.56
Age 4	.4322	.4361	.4267	.4309	.44

The differences in the proportions between North and West family of tables occurred because of differing childhood mortality patterns assumed in the model tables. The differences seem to merge with the advance in age.

The calculations presented in the table could not be extended beyond age 3 and 4 (i.e. year t+4) as the single year d_x values after age 4 were not available. However a complete life table for Bangladesh (1977 : 89-92) was available and based on this we calculated the identical proportions presented in the above table for ages up to 9 and 10. It was discovered that these proportions declined with increase in age and approached 0.5 at about age 10.

Due to the uncertainty of the appropriateness of the model life table for the Ghanaian situation, it was decided to use the proportions given in the last column of the above table. For deaths of cohort of year t which occurred in years beyond year t+4, a proportion of 0.5 was assumed to apply. Based on these calculations the tables in Appendices C1 and C2 were obtained.

Appendix C1

Male Births and Adjusted Deaths up to exact age 6
Study Area: 1950-72

Year of Birth	Number of Births	Age at Death from age x to x+1 0	1	2	3	4	5
1950	147	24	3	2	2	1	1
1951	106	12	2	2	1	0	1
1952	130	14	2	1	0	0	1
1953	132	19	2	1	2	1	0
1954	168	21	3	2	1	1	1
1955	151	12	2	2	1	2	1
1956	212	11	2	2	2	1	1
1957	210	17	4	5	3	0	0
1958	245	22	8	6	1	2	2
1959	258	25	5	6	3	2	3
1960	261	21	5	4	3	3	2
1961	232	25	5	4	2	1	1
1962	293	16	4	4	3	2	2
1963	264	26	5	4	2	2	1
1964	342	27	7	5	3	2	1
1965	314	26	5	3	1	1	1
1966	350	39	7	4	3	2	1
1967	341	26	6	5	2	1	1
1968	405	32	9	6	4	3	-
1969	386	31	8	7	5	-	-
1970	409	45	8	7	-	-	-
1971	435	32	7	-	-	-	-
1972	409	41	-	-	-	-	-

Source: Pregnancy History Data, 1974. Cape Coast Project.

Appendix C2

Female Births and Adjusted Deaths up to exact age 6
Study Area: 1950-72

Year of Birth	Number of Births	Age at Death from age x to x+1					
		0	1	2	3	4	5
1950	129	10	1	1	1	1	1
1951	110	9	1	1	2	1	1
1952	156	8	3	4	2	1	0
1953	133	13	3	2	1	0	0
1954	191	11	1	2	1	2	1
1955	164	14	1	1	1	1	0
1956	232	13	2	3	3	2	1
1957	229	15	5	4	1	0	1
1958	224	19	4	2	0	1	1
1959	247	29	5	4	3	1	1
1960	237	12	7	7	3	2	1
1961	259	20	2	2	1	1	0
1962	288	21	6	3	2	3	3
1963	291	20	4	5	3	2	1
1964	355	37	7	4	1	2	3
1965	328	25	3	4	3	2	2
1966	350	27	9	8	3	1	1
1967	323	20	3	3	5	4	3
1968	359	20	4	4	3	2	-
1969	392	30	13	8	3	-	-
1970	414	28	10	12	-	-	-
1971	387	27	9	-	-	-	-
1972	430	38	-	-	-	-	-

Source: Pregnancy History Data, 1974. Cape Coast Project.