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INFANT AND CHILDHOOD SURVIVORSHIP IN WEST AFRICA

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14p.

There are several reasons why the situation of infant and childhood mortality in West Africa deserves more attention than it has received in the past. Trends and changes in infant/child mortality are important because of their impact on growth rates and age structure. Also, it is a sensitive index of economic development and change and the health of a population. But finally and perhaps most importantly, infant and childhood deaths are not isolated occurinces but affect the majority of West African mothers. Recent survey data from rural Upper Volta, for example, indicate that of all women aged 15-49 only 39% had never lost any child. The proportion would be even lower if all these women had reached the end of their reproductive period even if one assumes an improvement in mortality conditions over time. Few women it seems, escape this experience. It would be difficult to argue, then, that infant and child mortality does not have profound effects on and implications for attitudes and behavior in other aspects of a woman's demographic and social life, in particular her fertility and family building behavior[1].

Given these considerations it is important to know in what ways and to what extent infant/child mortality is or may be affected by general economic and social changes related to development. This paper addresses itself to the situation of infant and child survivorship in West Africa with particular reference to its varied relationships with economic development as indicated in the findings of recent survey data from three West African countries.

The major difficulty in the study of infant and childhood mortality in West Africa has been the paucity of reliable data. Most data have been limited either in detail (most censuses) or in the degree to which they could be generalized to the larger situation (special surveys i.e. medical-nutritional). However, new sources of data have appeared, most notably the Sénégal

studies by Cantrelle et al[2]. which combined the detail and relative accuracy of longitudinal studies with a broader geographical frame of reference. These sources have indicated higher levels of infant and childhood mortality than occurs in most developing countries and a very distinctive pattern of deaths by age. Table 1 illustrates the comparative situation of infant mortality in West African countries with that of other developed and developing countries. Table 2 illustrates the difference in the age pattern of deaths in West African countries and in the Standard United Nations life tables. In the latter the proportion of deaths occurring in childhood is only a fraction of those occurring in infancy while in West Africa the proportion dying under age 1 is often equalled or even surpassed by the proportion dying over the age group 1-4.

The explanation for both the high levels and distinctive age pattern lies in the synergistic relationship between malnutrition and infection, and in the prominent role played by prolonged breastfeeding and abrupt weaning in the development of malnutrition.

The Situation of Infant and Child Mortality in West Africa

Ogbeide[3] has pointed out that West African children are exposed to a triple threat of illness and disease -- tropical diseases, common childhood illnesses, and 'economic' diseases such as malnutrition. Moreover, these three do not remain distinct but interact in a multiplicative relationship that results in increased severity and mortality from what otherwise would be minor illnesses. Common childhood illnesses which constitute relatively mild conditions in developed countries can pose a serious threat to life itself in developing countries, not because of any difference in virulence of the disease, but because of the inferior nutritional status of the children. Malnutrition increases susceptibility to disease and infection, leads to a more severe course of any illness,

TABLE 1

INFANT MORTALITY

COMPARATIVE SITUATION IN WEST AFRICA AND SELECTED COUNTRIES

Country	Infant Mortality Rate	Country	Infant Mortality Rate
Europe:		West Africa:	
Denmark	14.8	Dahomey	149
Sweden	11.7	Gambia	125
United Kingdom	18.4	Ghana	122
Greece	29.3	Guinea	216
Spain	27.3	Ivory Coast	138
		Liberia	137
North America:		Mali	190
Canada	19.3	Mauritania	137
United States	19.2	Niger	148
		Sierra Leone	136
Latin America:		Togo	163
Mexico	69	Upper Volta	182
Peru	72	Tanzania	
Venezuela	47	Uganda	
Ecuador	91		
Argentina	58		
Asia:			
Turkey	119		
India	139		
Pakistan	142		
Indonesia	125		
Phillipines	67		
Japan	13		

Source: 1972 World Population Data Sheet - Population Reference Bureau, Inc.

TABLE 2

Comparison of Proportions of Children

Dying in Age Groups 0 & 1-4

	$_1q_0$	$_4q_1$
Country		
Upper Volta	.182	.218
Chad	.160	.127
Northern Cameroon	.197	.173
Western Cameroon	.139	.147
Dahomey	.111	.194
Standard United Nations Life Table		
22	.150	.075
25	.180	.099
27	.200	.118

Source: R. Clairin, "The Assessment of Infant and Child Mortality from the Data Available in Africa," *The Population of Tropical Africa,* J. C. Caldwell and C. Okonjo, eds., Columbia University Press, New York, 1968 p. 199.

and is associated with an increased incidence of complicating conditions. Specifically, malnutrition interferes with the mechanisms by which the body protects itself from infection; it inhibits antibody formation, and increases the permeability of both skin and mucous membranes.[4] Thus, many organisms normally innoculous to a well-nourished child are pathogenic to the malnourished and cause a variety of infections of which the most common is diarrheal disease. The malnourished child will be further weakened and dehydrated if such diarrhea develops and may be pushed into a more severe state of malnutrition, such as kwashiorkor, with a poor prognosis for survival.

There are many factors responsible for the development of malnutrition -- sporadic or inadequate food supply, ignorance of proper diet, use of poor quality foods, unequal distribution of food within the family unit. However, a crucial factor in the nutritional development and health of the child is the length of time he is breast-fed and the circumstances of his weaning.

Lactation is practically universal and prolonged in West Africa, and might last from less than one to over three years depending upon the region or cultural area.[5] Given the lack of bacteriologically clean and undiluted milk, breastfeeding for up to two years, if adequately supplemented after the first six months with other foods, in particular protein, is felt to provide the child with the best nutritional resources.[6] Breastfeeding for at least the first six months is considered essential for life itself.[7] Bottle feeding, taking hold among some groups of urban women, has led to the development of what has been termed "diseases of semi-sophistication".[8] In tropical regions bottle feeding involves high risks of bacteriological contamination. For mothers with no refrigeration or proper cooking facilities, little money to spare on artificial milk, bottle feeding may mean a dilute and bacteriologically dangerous feed.[9]

After the first six months, when breast milk is no longer an adequate food source and must be supplemented, the types of supplementary feeds given are crucial. In many of the coastal areas of West Africa such foods consist of a protein-poor starchy gruel of corn, yam, or cassava.[10] In the northern regions of Ghana and Nigeria, in Upper Volta, and in Niger, however, children are given gruels of millet and sorghum which are at least nutritionally superior to those given on the coast.[11]

Weaning is a critical period in the development of malnutrition, for during weaning the child may undergo considerable physical and psychological trauma [especially if weaning is abrupt] in adjusting to an adult diet and to the lack of the mother's undivided attention. It is during this period that diarrhea is most likely to develop and in fact, it is so closely associated with weaning that it has been termed 'weanling diarrhea'. It is during this period in particular that the child faces the greatest risks of becoming seriously malnourished and is subject to increased risks of severe illness, infection, and death. Indeed, the peak incidence of childhood deaths coincides with the time period when most children are being weaned, that is at ages 2-3.

Hendrickse has summarized the pattern of illness and mortality in the zero to four age group in West Africa as follows:

> Combining the experience of others with our own, it would appear that there is considerable justification for describing a common pattern of morality in childhood applicable to most areas of West Africa. The salient features of this pattern can be designed as follows:
>
> 1) An extraordinarily high mortality rate, during the first five years of life greatly in excess of that in developed countries.
>
> 2) A large perinatal mortality rate largely as the result of poor antenatal services and poor obstetrics...
>
> 3) After the neonatal period, death occurs principly as a result of infectious disorders

> interacting with malnutrition. Many infections are the non-specific type which result mainly from unsanitary living conditions. These specific infections which contribute most to mortality are measles, malaria, tetanous, and tuberculosis ... In some areas meningitis is also an important cause of death.
>
> 4) Protein calorie malnutrition is the principle nutritional disorder which may cause death directly or interact with various infections. The peak incidence of this disorder is between the second and third year of life in West Africa.[12]

Also, not only do infection and malnutrition interact to produce a more severe illness in the West African child than in the child living in developed countries, but at any given time he is likely to have a greater number of infectious and parasitic conditions.

In view of such a complex of illness and disease, and the synergism between malnutrition and infection, it is not surprising that neither intense vaccination campaigns nor the provision of a hospital to care for acute conditions, would seem to lower death rates to any extent. There are so many facets to illness in West African children, many of which seem related to what Ogbeide[13] has termed the 'economic diseases' that to try to improve the situation by improving one aspect only uncovers the layers that are hidden beneath. To effect a more comprehensive change it would seem that both widespread curative and preventive health care must go hand in hand with general economic development. In the interim, while lack of adequate health care and malnutrition remain salient features of the level and pattern of disease in West Africa, malnutrition is perhaps the more serious factor. For while health care is forced to be very often 'after the fact' rather than preventive, malnutrition is a predisposing factor in both the incidence and the outcome of disease.

It is obvious that general economic development, by improving the level

of poverty that restricts ability to acquire available food, by improvements in agricultural and distribution technology that might better assure the supply of food, by improving sanitary conditions of living, and by raising education levels, could have a profound effect on death rates. However, just as there are aspects of economic development and change that tend to increase fertility rather than to decrease it, there may also be aspects that could detrimentally effect the chances of survival. This paper will discuss some of the implications for the relationship between economic development and infant and childhood mortality that were found in a cross-national study of infant and childhood survivorship in West Africa. The data are drawn from the findings of three fertility surveys carried out in both the urban-rural areas of Ghana in 1965-66, in Upper Volta in 1969 and in Niger in 1970. Findings relating to both demographic and social differentials in survivorship are presented, but major focus is given to the role of economic development and social change on the varying risks of death in these early age groups, in as much as the restrictions of a cross-sectional analysis permit. The survivorship information provided by the surveys is based on retrospective reports collected in detailed pregnancy histories and as such are subject to the limitations of all retrospective information, primarily having to do with the problem of memory error. However, a detailed study of these data has shown the extent of such error to be within acceptable limits.[14] Most importantly the surveys do provide a rich source of demographic and social information relating to infant and childhood survivorship within a comparative rural-urban cross-national framework. In addition, these data are particularly useful to this discussion as they relate to three countries at different ends of the development spectrum of West Africa.

Data Source

As details of the three surveys are published elsewhere[15], only a brief description of the structure of each is presented in Table 3. The three surveys used basically similar questionnaires and provide a broad range of comparable demographic and socio-economic data on respondents. Besides basic demographic and socio-economic data on each respondent, detailed pregnancy histories were collected which included the following information for each of a possible total of 14 pregnancies:

a) age of mother at birth

b) outcome of pregnancy (live or still birth)

c) length of lactation in months

d) length of post-partum absention in months

e) survival or death of child

f) age of child at death (usually in one year age group)

This format permitted parity-specific analysis linking the survival or death of any given child directly with circumstances surrounding his birth (most importantly the length of time he was breastfed), as well as factors relating to the current family situation.

Economic Development and Mortality Decline:

Industrialization and economic development have traditionally been related to declines in general mortality levels, and infant mortality has been found to be a most sentitive index of such changes. However, there has been some discussion whether such declines have been due to general structural changes concommittent with development and rising standards of living or to the development of modern medicine and medical intervention. The debate has relevance for countries developing today, for while much of the decline in mortality in these areas is often felt to be due to medical technology--"imported death control," it can be seen from the discussion above that

TABLE 3

Size of the Three West African Surveys, 1965-71

Date, Country & Sample	Number of Women Interviewed (All Marital Statuses, ages 15-49)	Number of Children Ever Born Alive
Ghana (1965-66)		
Urban (Accra)	2,150	4,549
Rural	1,960	6,333
Upper Volta (1969)		
Urban (Ouagadougou)	778	2,240
(Bobo-Diolasso)	370	1,140
Rural-Urban Fringe	237	730
Rural	444	1,589
Niger (1970)		
Urban (Niamey)[1]	2,124	5,229
Rural (Zarma)	814	2,630
(Hausa)	694	not included here

[1]Refers to the principal sample. Two subsamples were also drawn from this sample, and were re-interviewed by a different interviewer from the one who had carried out the first interview. These data will be used where there are no Principal sample data available.

improvements in much of the situation may also require general economic and structural change.

Historically McKeown[16] has placed the responsibility for the decline in mortality in eighteenth century Europe to improvements in public health, sewage systems, and improved agricultural techniques, rather than to any medical improvements. Only the development of the smallpox vaccine was shown to have any noticeable effect on the death rate. In the contemporary Senegalese situation, Cantrelle[17] came to similar conclusions. There it was found that infant mortality rates did not fall until ten years after the introduction of a health center and specifically not until agricultural improvements led to an increased output per capita of food crops. In concluding, the study stressed the importance of an abundant and steady food supply in lowering the rates of childhood deaths.

One of the difficulties in interpreting the role of economic development is the lack of clarity of the concepts used. Economic development and social change are two notoriously broad concepts and as such pose serious difficulties for both theory and research. It is necessary to translate these broader concepts to an intermediate level and specify the mechanisms of change such as has been done in the case of fertility analysis by Blake and Davis.[18] For example, while urbanization may be said to be related to increases in fertility it might be through the intervening variable of exposure to conception and through the mechanism of declines in the length of lactation and consequent shortening of birth intervals. In this investigation similar intervening variables are discussed as they relate to mortality change. In this way a child's chances of survival is viewed as the extent to which he is exposed to illness and disease, and the resources to which he can call to combat it. Thus, nutritional status and access to modern medical care can be seen as

resources, the former internal and physiological and the latter external, upon which a child could draw to combat an acquired illness or disease. If it is assumed that for the most part children are equally exposed to the risks of disease, then differences in both the internal and external resources of the child will be largely responsible for the outcome of the disease. However, as various environmental factors are likely to influence the possibility of contamination and the dissemination of disease, differentially exposing children to illness, a measure of such conditions is also desirable.

Out of the available survey data the length of lactation, type of medical care actually used at last illness or pregnancy, and the declared preferred type of care in the event of possible illness were used as indices of the internal and external resources. Data on the type of toilet and water facilities used by the family at the time of the interview were used to gauge differences in the exposure variable. All of these indices have shortcomings[19] but they were the only indices available and in spite of their deficiencies, gave profitable results. Only the medical care variable was not sufficiently discriminating; this was not felt to reflect the inappropriateness of medical care in controlling disease, but was rather taken as an indication of the inadequacy of the particular measure used.

In the present analysis the relationship between economic development and mortality was approached on several levels. First, on the national level in a discussion of the differences in levels and patterns of mortality between the three surveys as a whole; secondly, on the rural-urban level and finally at the social group level. Social group differences studied involved the differential survivorship of children whose mothers were or were not educated, of children whose mothers were currently in monogamous or polygynous unions, and of children whose mothers who were either Christian, Muslim, or Animist. However, as there are a number of interrelations between the edu-

cation, religion, and polygyny variables, these differentials are discussed at the summary stage in terms of 'modern' and 'traditional' groups. This distinction has been used in various analyses of developing societies because there seem to be aspects of social organization that seem to be most conveniently conveyed by these terms. Unfortunately, these concepts do not parallel an analytic clarity their usefulness as convenient descriptive terms. It is difficult to separate out what should be called modern and traditional. It is also increasingly apparent that the modern-traditional distinction is not a single dichotomy nor a uni-directional movement from one polar state to another. Studies have found that persons who are classified as modern in one dimension of their behavior or attitudes were at the same time classified as traditional on another dimension, and as Plotnicov has observed, "if contradictions are present they are in the mind of the observer and not the observed."[20]

This study does not attempt an in-depth discussion of the conceptual difficulties of the modern-traditional dichotomy; the purpose of this discussion is to point out the need to avoid conferring to these concepts a reality they do not possess, and to confine their use to one of a convenient but rough descriptive tool. Thus in the discussion that follows, results are discussed in terms of detailed findings in terms of religion, education, and polygyny. Only at the summary stage are the findings placed in the modern-traditional framework, with women who are at once young (under 30) Christian, educated, and nomogamous being termed 'modern' and those who are at once older, (over 30 years) Muslim or Animist, uneducated and polynynous, 'traditional.'

Survey Findings:

Table 4 presents the levels and age patterns of mortality found in the three surveys. The Upper Volta samples had the lowest proportions of children surviving of the three surveys, and the Ghanaian samples the highest. Rural samples had lower proportions of children surviving than did the urban samples within each of the countries surveyed.

The age pattern reported in previous sources was also found in these surveys with the proportion dying over the age group 1-4 being as high or higher than the proportion dying in the age group zero. Detailed investigation indicated that this pattern did not seem to be due to age misstatement about the twelve-month period which might cause deaths actually occurring in infancy to be reported as occurring in the age group 1-4.[21] If this were the case, the proportions dying would tend to be very high at age one, and drop off sharply at ages 2-4. However, the proportions dying actually declined very gradually over the ages 1 through 4. While there is a general problem of understatement due to memory error and omission with the use of retrospective data, the only clear evidence of this was found among older women (aged 30 and above) in the rural sample of the Upper Volta survey. However, in view of this problem, the proportions presented here can only be said to represent the lower boundary of the actual mortality situation.

It should be noted that the differences in survivorship between urban and rural areas seemed to be concentrated more in the 1-4 than in the 0 age group. Also, the differences between the proportions dying in age 0 group were not as consistently statistically significant as were the proportions in the 1-4 age group. This might be due either to the greater probability of contamination of the 0 proportions by underreporting than of the 1-4, or to the greater sensitivity of the 1-4 proportions to differences in

TABLE 4[a]

Levels & Age Patterns of Deaths: Ghana, Upper Volta & Niger

Proportions of children ever born alive, surviving to time of interview, and proportion dying in age groups 0, 1-4, & 5+

Country & Sample	Proportion Surviving	Proportion Dying in Age Group			Number of Children Born Alive
		0	1-4	5+	
Upper Volta					
Ouagadougau	.738	.106	.135	.024	2240
Bobo-Dioulasso	.774	.109	.107	.012	1140
Rural-Urban Fringe	.673	.111	.179	.033	730
Rural	.671	.107	.184	.030	1589
Niger					
Niamey	.781	.065[a]	.102[a]	.019	5229
Rural	.741		not available		2630
Ghana					
Accra	.800	.060	.060	.065	4549
Rural	.707	.096	.123	.052	4485

[a] Based on less than 45 births.

TABLE 4[b]

Test of Significance Results

Intra-Survey Differences:

	Proportions Surviving	Proportion Dying in Age Group		
		0	1-4	5+
Upper Volta				
Ouaga-Bobo	.001	N.S.	.001	.001
-R-U. Fringe	.001	N.S.	.001	.005
-Rural	.001	N.S.	.001	N.S.
Bobo-R-U. Fringe	.001	N.S.	.001	.001
-Rural	.001	N.S.	.001	.001
R-U. Fringe-Rural	N.S.	N.S.	N.S.	N.S.
Ghana				
Accra-Rural	.001	.001	.001	.001
Niger				
Niamey-Rural	.001	-	-	-

Inter-Survey Differences:

Ouaga-Accra	.001	.001	.001	.001
-Niamey	.001	.001	.001	N.S.
-Ghana Rural	.001	.03	.01	.001
-Niger Rural	N.S.	-	-	-
Bobo-Accra	.001	.001	.001	.001
-Niamey	.001	.001	N.S.	N.S.
-Ghana Rural	.001	.001	.003	N.S.
-Niger Rural	.001	-	-	-
R-U. Fringe-Accra	.001	.001	.001	.001
-Niamey	.001	.001	.001	.02
-Ghana Rural	.001	.006	.001	.001
-Niger Rural	.001	-	-	-
U.V Rural-Accra	.001	.001	.001	.001
-Niamey	.001	.001	.001	.02
-Ghana Rural	.001	.02	.001	.001
-Niger Rural	.001	-	-	-
Ghana Accra-Niamey	.001	N.S.	.001	.001
-Niger Rural	.001	.001	.003	.001

the environmental/economic situations of the various sample areas. While the former explanation is undoubtedly true, the findings of an analysis of mortality change in childhood over the past decade from these same data indicate that improvements in risks of death came predominantly in the 1-4 age group,[22] suggesting that the latter interpretation is also correct. Mortality in childhood, being so closely associated with malnutrition and infectious diseases, should be more responsive to changes in the general environment than would infant mortality, since the latter is so heavily affected by neo-natal mortality, of which many causes are endogenous.

In terms of social or 'traditional-modern' differentials the 'modern' groups had higher survivorship than did the 'traditional' ones (Tables 5, 6,7). Specifically, children of educated mothers had higher survivorship than did those of uneducated mothers, those of Christians higher than those of Muslims or Animists, and those of monogamous wives higher than those of polygynous ones.

In terms of the survivorship patterns by the intervening variables, that is, the length of lactation, access to medical care, and the type of water system or toilet facility used, the following relationships were found. First, generally the length of lactation was positively related to survival (Table 8). Survivorship was higher among infants and children who had been breastfed longer, but not necessarily the longest periods of time. Medical care, whether simply desired or actually received, showed an inconsistent relationship to survivorshiop (Table 9). This was probably due to the character of these particular medical care indices as they did not relate in a direct way to the survival or death of any particular child but rather referred to care desired or received by their mothers. Finally, survivorship by types of water supply and toilet facility used showed clear, strong differences, with the traditional types of water and toilet facilities

TABLE 5

Education and Survivorship:
Ghana, Upper Volta, and Niger

	Proportions Surviving of Children Ever Born by Education and Age of Mother					
Age of Mother:	20-29		30+		TOTAL	
Country & Sample / Education:	Educated	Not Educated	Educated	Not Educated	Educated	Not Educated
Upper Volta						
Ouagadougou	.842	.751	.792	.642	.718	.686
Bobo-Dioulasso	.835	.744	.916	.708	.873	.738
Rural-Urban Fringe	.611[a]	.741	.727[a]	.630	.655	.673
Rural	.800[a]	.727	.730	.645	.745	.668
Niger						
Niamey	.860	.820	.766	.732	.816	.772
Rural	.929[a]	.772	-	.722	.950[a]	.741
Ghana						
Accra	.880	.816	.788	.768	.830	.787
Rural	.797	.763	.766	.671	.788	.706

[a]Based on less than 45 births

Levels of Significance of Differences: Total Educated-Not Educated

Upper Volta		Niger		Ghana	
Ouagadougou	.01	Niamey	.001	Accra	.001
Bobo-Dioulasso	.001	Rural	*	Rural	.001
R-U Fringe	N.S.				
Rural	.001				

*Not enough cases to calculate test of significance.

TABLE 6

Religion & Survivorship: Ghana, Upper Volta & Niger

Country & Sample	Age of Mother Religion	20-29 Christian	20-29 Muslim	20-29 Animist	30+ Christian	30+ Muslin	30+ Animist	Total Christian	Total Muslim	Total Animist
Upper Volta										
Ouagadougou		.830	.740	.750[a]	.728	.609	.855	.770	.667	.826
Bobo-Dioulasso		.822	.781	.696	.840	.684	.947[a]	.831	.726	.810
Rural-Urban Fringe		.637	.742	--	.674	.627	.590	.658	.678	.638
Rural		.750[a]	.717	.732	.627	.712	.636	.647	.714	.662
Niger										
Niamey		.945	.822	.750[a]	.857	.732	--	.903	.773	.769[a]
Rural		--	.774	--	--	.724	--	--	.743	--
Ghana										
Accra		.861	.783	.806	.795	.656	.780	.821	.721	.790
Rural		.809	.853	.725	.775	.603	.610	.777	.753	.657

[a]Based on less than 45 births; results for cells with less than 10 cases not reported.

Levels of Significance of Differences: Total Christian-Muslim, Muslim-Animist and Christian-Animist

Upper Volta	C-M	M-A	C-A	Niger	C-M	M-A	C-A	Ghana	C-M	M-A	C-A
Ouagadougou	.001	.001	.003	Niamey	.001	N.S.	.001	Accra	.001	.001	.001
Bobo-Dioulasso	.001	.001	N.S.	Rural	*	*	*	Rural	.02	.001	.001
R.U. Fringe	N.S.	N.S.	N.S.								
Rural	.005	.002	N.S.								

*Not enough cases to calculate test of significance.

TABLE 7

Polygyny and Survivorship: Ghana, Upper Volta and Niger

		Proportions Surviving of Children Ever Born Alive by Current Marital Situation and Age of Mother					
	Age of Mother:	20-29		30+		TOTAL	
Country & Sample	Current Marital Situation:	Monogamous	Polygynous	Monogamous	Polygynous	Monogamous	Polygynous
Upper Volta**							
Ouagadougou		.795	.743	.707	.628	.747	.673
Bobo-Dioulasso		.808	.780	.761	.706	.794	.730
Rural-Urban Fringe		.648	.782	.641	.661	.644	.706
Rural		.638	.776	.654	.644	.649	.681
Niger							
Niamey (Sub-Sample "B")		.839	.889[a]	.792	.648	.810	.718
Rural				(not available)			
Ghana							
Accra		.849	.817	.792	.755	.818	.776
Rural		.783	.753	.731	.621	.753	.674

[a]Based on less than 45 births; results for cells with less than 10 cases not reported.

Levels of Significance of Differences: Total Monogamous-Polygynous

Upper Volta		Niger		Ghana	
Ouagadougou	.001	Niamey	.002	Accra	.001
Bobo-Dioulasso	.001	Rural	-	Rural	.001
Rural-Urban Fringe	.006				
Rural	.03				

TABLE 8

Survivorship by Length of Lactation:
Ghana, Upper Volta, & Niger

Country & Sample	Proportions Surviving of Children Ever Born Alive by the Length of Time Each Was Breastfed						
	Length of Lactation (in months)						
	1-5	6-11	12-17	18-23	24-29	30-35	36+
Upper Volta							
Ouagadougou	.182	.489	.685	.838	.804	.852	.848
Bobo-Dioulasso	.071	.578	.859	.798	.880	.833[a]	.800[a]
Rural-U. Fringe	.159	.167[a]	.526	.756[a]	.724	.878	.786
Rural	.025	.097[a]	.313	.662	.734	.724[a]	.832
Niger							
Niamey (Sub-Sample "B")	.286[a]		.520[a]	.885	.868	----	1.000[a]
Rural	not available						
Ghana							
Accra	.627		.875	.885	.864	---	.933[a]
Rural	.279		.785	.866	.753	.868[a]	.764

* Based on less than 45 births; results for cells based on less than 10 cases not reported

TABLE 9

Survivorship by Medical Care

Proportions Surviving of Children Ever Born Alive by Mother's Access to Medical Care

Survey, Sample	Type of Care	
	Modern- Medical	Traditional Non-Medical
A) Desired Medical Care [to whom Respondent would go if ill]		
Upper Volta		
Ouagadougau	.689	.758
Bobo-Dioulasso	.791	.589
Rural-Urban Fringe	.568	.519*
Rural	.667	.671
Niger		
Niamey	not available	
Rural		
Ghana		
Accra	.829	.824*
Rural	.760	.627
B) Care Received in illness [who treated Respondent for Illness in last 12 months]		
Upper Volta		
Ouagadougau	.696	.696
Bobo-Dioulasso	.792	.665
Rural-Urban Fringe	.693	.750
Rural	.626	.723
Niger		
Niamey	not available	
Rural		
Ghana		
Accra	not available	
Rural		

Survivorship by Medical Care (Cont'd)

Survey, Sample	Type of Care		
	Modern-Medical	Traditional	Non-Medical
C) Care Received in Delivery [who delivered children born in last 12 months]			
Upper Volta			
Ouagadougan	.780		.760
Bobo-Dioulasso	.833		.845
Rural- Urban Fringe	.770		.628*
Rural	.750		.722
Niger			
Niamey			
Rural	not available		
Ghana	(Doctor)	(Midwife)	
Accra	.860	.883	.910
Rural	.912	.756	.793

A) Modern-Medical includes doctors, nurses, midwives (formally trained and otherwise) Traditional, Non-Medical includes traditional healers, herbalists, diviners (marabouts [Muslim priests]).

B) Here Traditional Non-Medical includes also no help at delivery.

* Based on less than 45 births.

Survivorship by Water & Toilet Facilities: Ghana

Sample	a) Water Supply:	Proportions Surviving of Children Ever Born to Women by Type of Water Supply and Toilet-Facility Used at Time of Interview			
		Piped	Public Tap or Pipe	River or Pond	Well
Accra		.833	.775	--	--
Rural		--	.765	.688	.756

	b) Toilet facility:	Flush	Pit Latrine	Bucket	Bush	Public Latrine
Accra		.845	.786	.809	.706	.767
Rural		--	.752	.643[a]	.605	.738

[a] Based on less than 45 births; results for cells with less than 10 not reported.

involving a substantial threat to the life of the child (Table 10). However, in this last case it was difficult to separate out whether survivorship levels were a product of the effects of the water supply or toilet facility themselves or rather merely a reflection of differences in social status and levels of living in the areas using the various types of facilities. For example, in the urban samples, children of persons who have water piped into their homes had higher survivor experience than did those using a public pipe or tap. Since both the private and public piped water came from the same source, it is likely that the slight advantage enjoyed by those using the former was probably a reflection of their higher social status. However, it is also conceivable that the sharing of a public tap with a number of other people would be a favorable site for the spread of disease. Similarly, in the case of the various toilet facilities where the findings may be reflecting social status and level of living it is also possible that using a public latrine increases the chances of acquiring and spreading infectious disease to even the youngest members of the family who may not as yet use the latrine themselves. It is special interest in this regard to note that the very high proportion of rural children dying who used a bush latrine facility was concentrated in the one to four age group, at .213 while the proportion dying 0-1 was only .088. Similar proportions with the 1-4 age group for rural respondents using pit or public latrine facilities were both only .089 and the proportions dying 0-1 were all similar--.094 (pit), and .085 (public latrine). It is very likely that the use of an open field for defecation encourages the acquisition of many infectious and parasitic diseases, the results of which are manifested in the higher proportion of children using such facilities dying in the age group 1-4 just at the age when they themselves are beginning to use such facilities.

Discussion

While the above would seem to support the general hypothesis of a positive relationship between economic development and infant/child survivorship, close inspection revealed that the relationship was not a direct one. There were a number of descrepancies in the findings which raised some questions about the hypothesized relationship. They were:

1) at the national level in terms of general survivorship,
2) at the national level in terms of age-specific survivorship, and
3) at the rural-urban and social group level.

1. The National Survivorship Levels

At the national level the Niger survey showed almost as high a survivorship as did the Ghanaian survey despite the great difference in the levels of economic development indicated by all indices presented in Table 11. While per capita income may not accurately reflect actual differences in levels of living between these three countries for a variety of reasons, the levels of the education and health measures lend support to the general pattern of Ghana having a higher level of economic development than either Niger or Upper Volta. Indeed, socio-economic data taken from within the surveys themselves, summarized in Table 12, also reflect this same pattern. If the levels of infant and childhood survivorship were closely related to economic development, one would expect that the Ghanaian samples would have much higher levels of survivorship than the samples of the other two countries, which they did not, and that the Niger results would be very close to the Voltaic results in terms of the proportion of children surviving, and they were not.

While these findings present a somewhat confusing picture a partial explanation might be found in the nutritional pattern and differences in

TABLE 11

Comparative Situation of Ghana, Upper Volta, & Niger: Selected Indices

	Ghana	Upper Volta	Niger
Estimated Per Capita National Income 1. (expressed in U.S. $)	$211 (1963)	$45 (1963)	$78 (1963)
School Enrollment Ratios; 1st and 2nd levels 2. (Proportion of school age population in school)	57% (1965) (ages 6-19)	7% (1967) (ages 6-18)	8% (1968) (ages 7-19)
Level of Health Services 3.			
Population per M.D.	15,200 (1969)	92,759 (1969)	56,667 (1969)
Population per hospital bed	793 (1970)	1,640	1,903
Dietary Levels 4.			
Calories/day *	1900	1842	2481
Grams Protein/day	41.0	63.8	80.2
Grams Animal Protein/day	8.1	4.1	9.0

Sources:

1. U.N. Statistical Yearbook 1971 Table 185, pg. 594
2. Unesco Statistical Yearbook 1970 Table 2.5, pg. 82
3. U.N. Statistical Yearbook 1971 Table 201, pg. 711
4. Economic Survey of Africa 1960 Vol. 1, U.N. Table 7, pg. 15

* Recommended Daily Intake of Nutrients (for Tanzania)

	Calories/Day			Grams Protein/Day		
	Sedentary	Active	Very Active	Sedentary	Active	Very Active
Males	2200	2500	3000	60	65	70
Females	1800	2200	2500	55	60	65

Source: M.C. Latham, " Nutritional Studies in Tanzania", *World Review of Nutrition and Dietetics*, Vol. 7, 1967, Tables II, pg. 41.

TABLE 12

Comparative Socio-Economic Data: Ghana, Upper Volta and Niger*
Percentage Distribution of all Women According to Various Characteristics

		Ghana		Upper Volta			Niger	
Characteristics:		Accra	Rural	Ouaga.	Bobo	Rural	Niamey	Rural
Education:	Educated	47	16	21	22	3	13	3
	Not Ed.	53	84	79	78	97	83	97
	TOTAL	100	100	100	100	100	99	100
Religion:	Christian	73	55	33	30	18	5	.5
	Muslim	14	3	63	61	29	94	99.0
	Animist	13	42	4	9	53	1	.5
	TOTAL	100	100	100	100	100	100	100
Occupation:	Modern[1]	18		6	6		3	
	Traditional[2]	44		21	21		14	
	Housewives[3]	38		73	72		80	
	TOTAL	100		100	99		98[4]	

[1] Includes students.

[2] Includes petty traders, local food preparers.

[3] Includes all women and currently in labor force, i.e., pregnant and sick women. Also in Ouagadougou also includes women who said they were "cultivateur."

[4] Niger data also includes another 2% of women who reported themselves as prostitutes.

*Source: After Janet E. Pool. "A Cross-Comparative Study of Aspects of Conjugal Behavior Among Women in 3 West African Countries." Canadian Journal of African Studies, VI, ii (1972) Table II, pg. 238.

population density and agricultural capacity of the three areas. Both northern Ghana and central Upper Volta are plagued by high population densities on land which has low agricultural potential and, in some cases the available arable land is actually decreasing in size.[23] Both of these areas are subject to "seasonal hunger" that sees considerable hunger, weight loss and morbidity among their inhabitants.[24] Niger, on the other hand, while certainly not possessive of better agricultural land than the other two areas, does not have the same problem of high population densities. Also, the caloric and protein intake levels shown in Table 11 indicate that Niger occupies a favored position relative to both Ghana and Upper Volta in terms of the nutritional situation, with Upper Volta having the worst of the three. This is also reflective of the different food staples and the availability of animal protein in the three areas. The Savanah countries depend on richer staples in terms of vegetable protein and have greater access to animal protein since these areas do not have the problem of the Tsetse fly as do parts of Ghana. Niger, without the problem of population density would seem to have been able to take full advantage of these factors.

2. Age Pattern

In terms of the age-specific findings while the proportion dying in the age group 0 and 1-4 follow the general survivorship pattern with the Ghanaian survey having higher survivorship than the other two surveys, the proportion of children dying over age 5 is distinctly higher in the Ghanaian than in the Niger and Upper Volta surveys. While it is somewhat difficult to interpret this finding because there was no upper limit to the age group supplied, the explanation might lie in age misstatement--children actually under age 5 at death might be reported as being older. If this were the case one would expect that the reported proportions dying over age 5 would be higher among older, and especially older rural, women. But Table 13 shows that while the proportion dying at age 5 and above did rise with age of

TABLE 13

Proportions of Children Ever Born Dying over Age 5 by Age of Mother: Ghana

	Proportions dying to Mothers aged:					
Sample	15-19	20-24	25-29	30-34	35-39	40-49
Accra	.127	.071	.048	.081	.080	.097
Rural	.080	.054	.051	.048	.056	.046

mother, they did so mainly in the Accra sample and that the highest proportion for both rural and urban samples was that ages 15-19. Also, the urban proportions were consistently higher than the rural ones. While age misstatement might well a partial role in this peculiar age pattern it does not explain the higher proportions dying over age 5 in the urban areas, nor to the youngest mothers. Neither does it explain why misstatement should disproportionately effect the Ghanaian samples in comparison with the Niger and Upper Volta ones.

A more staisfactory explanation might be the one put forth by Hendrickse[25] who noted an increase in the number of deaths over age 5 in Nigeria. These deaths were due principly to tuberclulosis and malaria, whereas the classic pattern, with malaria at least, had been high mortality rate in infancy and childhood (under age 5) and protection from severe attacks after age 5 because of acquired resistance.

> The high percentage of deaths ascribed to malaria in older children is rather disturbing. The impression has grown over the past few years that the pattern of malaria in childhood is altering. Whereas previously the main brunt of the disease appeared to be in the first two or three yeares of life, we have been seeing older children with severe forms of the disease. A likely explanation for this change in pattern seems to be that many infants are being traced on malarial chemoprophylaxis, mainly in Infant Welfare Clinics, during their first year or two of life. This probably prevents a build-up of immunity to malaria and when antimalarials are discontinued, one's regular attendence at clinics cease, these children behave like non-immunes and develop acute severe malaria.[26]

Such a situation could also explain the high proportion dying over 5 in Ghana. It would account for the fact that these deaths occurred in Accra, for it would be there that mothers would have greater access to malarial chemoprophylaxis for their children and therefore would be more likely to develop the late non-immune behavior. It would also account

for the lower proportions dying over five in the Upper Volta and Niger surveys for these countries are only on the edge of the "malarial belt"[27] and while malaria is still a threat in both of these areas, it does not at all equal that of the situation in Accra.

It would also be in Accra that the incidence of tuberculosis could be expected to be greatest as tuberculosis is known to be found more frequently in urban than in rural areas due to overcrowding. Infection with tuberculosis bacteria can lead simply to a mild subclinical state of the disease which, although contributing to the general ill health of the child, subsequently confers some degree of immunity to T.B. However, exposure to massive infection -- such as to the sputum of an acute TB patient -- can override a previously acquired immunity. Thus, while in most developing countries mortality from TB in childhood is greatest in the period of infancy, when general mortality conditions improve, such as they no doubt have in Accra,[28] children may survive infancy and early childhood only to fall prey in late childhood (ages 5-10) to a subclinical case of TB precipitated into an acute case by continual reinfection due to the conditions of life in the urban area. Living in close quarters with a large number of other persons therefore can be of central importance in facilitating both the primary infection and the re-infection of a child with TB bacteria and overcrowding is a dominant characteristic of life for the majority of the people living in the large cities of West Africa such as Accra.

If Hendrickse's explanation can be accepted it provides an illustration of the possible negative influences that development can have on mortality -- on one hand an unintentional increase in mortality due to a public health measure (malarial prophylaxis) not followed through to its logical conclusion, and on the other an increase in morbidity and mortality due to the changes (urbanization) concomitant with development.

3. The Rural-Urban and Social Group Differential

At the rural-urban level the advantage of the urban areas over the rural in keeping the children alive was not consistent. In the Upper Volta and Niger surveys the urban samples generally had higher levels of child survivorship than did the rural samples but this was largely restricted to children whose mothers could be termed 'modern'. That is, those who were educated, monogamous, and/or Christian. In the case of children of mothers in the so-called 'traditional' sector of urban society, the older polygynous, Muslim, Animist, uneducated women the urban advantage over the rural was slight and the times entirely reversed. To give coherence to this set of seemingly conflicting findings, the following explanation was proposed. Both the traditional factors of prolonged lactation and the modern factors such as greater access to various amenities (i.e. modern medical care, sewage disposal or water supply) all had positive effects on the chances of survival of young children (Tables 8,9,10). However, certain of these factors were relatively more important in the rural or urban situation and were furthermore differentially distributed among the education, religion, and martial union groups so that they tended to work in a sort of balanced system.

Generally, urban areas tend to maximize access to modern amenities but to shorten the traditional lengths of lactation. In the rural areas modern amenities may be relatively few or nonexistent but lactation there is still prolonged in accordance to tradition. In the cities, for the most part, the negative effects of shorter durations of lactation are offset by the greater access to the modern amenities but in the rural areas the traditional factor of prolonged lactation is still of paramount importance in keeping children alive. This can be clearly seen in Table 8 where the shorter durations of lactation are much more detrimental to survivorship in the rural samples than are the same durations in the urban ones. But where traditional lactation practices have been so changed that durations

fall below a critical level that would appear to be the under one year category, and where access to modern factors, even in the urban areas, would seem to be only marginal (i.e. among the urban traditional sector -- children of urban mothers who are older, uneducated, Muslim or Animist and Polygynous) levels of survivorship are detrimentally affected. In such cases, survivorship is higher in the rural areas where lactation is prolonged than it is in the urban areas. Thus when access to modern amenities is more or less equally limited in both rural and urban groups, the traditional factor of prolonged lactation is of central importance in determining survivorship levels.

The Ghanaian case offered a slight variant to this pattern. For most sub-groups of both the traditional and modern sectors in the Ghanian survey survivorship seemed to be more sensitive to access to modern amenities than was the case in Upper Volta and Niger. Here the 'traditional' groups were at a definite advantage if they lived in the urban area. Only the children of uneducated or monogamous Muslims and of uneducated Christians had higher survivorship in the rural than in the urban area.[29] This seemed to be because there had been some development of the rural areas as indicated by the presence of 'modern' sewage and toilet facilities in Table 10. Moreover in both urban and rural areas these amenities were not evenly distributed over all groups. The amenities offered by the city to the traditional sector, even if poor, were much superior to those available to them in the rural areas and the positive influence of such urban amenities seemed to out-weigh the benefits of the characteristically longer breastfeeding in the rural areas. For the cases of the uneducated or monogamous Muslims and the uneducated Christians for whose children the rural areas offered higher survivorship than did the urban area, the following explanation was found. Being Muslim was associated with the lowest access to modern amenities of any urban group in the urban area, but with the

longest lengths of lactation in the rural area. Also, Muslims were not particularily disadvantaged in terms of access to modern amenities in the rural areas. Thus Muslim survivorship might well be expected to be higher in the rural than in the urban areas. Being Christian was associated with high access to amenities in the rural areas (where being Christian even if uneducated seemed to be important in commanding scarce resources) while in the urban area it was associated generally with the shortest lengths of lactation and, if also uneducated, with lower access to urban amenities. Thus the urban area can be seen as more detrimental to the survivorship of children of uneducated Christians relative than was the rural area which offered both the positive effects of access to scarce amenities and prolonged lactation.

Two things emerged from this discussion. First, it would seem that the importance of the traditional factor of prolonged lactation, while beneficial to survivorship, is only relative. Where access to modern amenities is restricted prolonged lactation is important, but where access is better the influence of lactation is reduced and only very short durations detrimental to survival. For the borderline cases, where access is somewhat restricted, the length of lactation again plays an important role, However it would seem that the power of this explanation is largely a function of the relative levels of development of the rural and urban areas, and in terms of keeping greater proportions of children alive, the greater access to amenities, usually but not always associated with urban life, is more efficient than prolonged lactation. However, the 'best' situation would seem to be the one which combines the two, greater access and prolonged lactation. Certainly this study would suggest with others[30] that a sharp shortening or complete abandoning of breastfeeding, for all but a very small urban group, would be highly undesirable.

Secondly, this discussion underlines the difficulties of discussing modern-traditional or even educational, religious or polygynous-monogamous differentials when dealing with large areas and different countries. It is obvious both from the discussion above and from Table 12 that categorizing respondents by social groups may not mean the same thing in terms of socio-economic or 'modern-traditional' status from one country, or even from one region, to another. For example, being Christian in Upper Volta or Niger, where one is in the minority and most likely a migrant from another country, is very different from being a Christian in Ghana where Christianity has had a long history. Similarly being Muslim in Upper Volta or Niger in an urban area might well be correlated with higher socio-economic status, while in Accra a Muslim is just as likely to be an economically marginal migrant living in one of the migrant communities of the area.

Summary

The foregoing discussion genreally supports the idea that economic development can be crucial in lowering the high rates in infant and childhood deaths. It also underlines the fact that it can also work to increase mortality. This study, in particular the findings relating to the differences in survirorship at the national level, would tend to support the conclusion of Cantrelle that the availability of an abundant and steady food supply is of importance in lowering the death rates given the central role played by malnutrition in the disease pattern of the area. However malnutrition is only one of the risks facing the West African child; the other half of the synergism belongs to the role of infectious and parasitic disease. The intensity of such diseases may be due in part to the tropical climate and environment , but it is largely also due to existing ways of conducting daily living that tend to perpetuate the spread of infection and disease. The importance of modern amenities such as an uncontaminated water supply and at least a covered sewage disposal system are easliy seen and are reflected in the findings of this study relative to the much

higher proportions dying in the age group 1-4 among children using the 'bush' as opposed to other types of latrine facilities. Even simple structural change in rural villages, like the building of proper latrines, or the covering of wells can have an effect on illness and survivorship.

However, economic development and its concommitant changes also have negative effects on survivorship. The most important example from this study is the decline in the lengths of lactation in the urban areas and its role in the higher death rates among certain segments of urban society. Such change has important implications not only for mortality levels but for fertility levels as well. Declines in lengths of lactation may lead to increases in mortality in childhood. But it can also have feedback effects on fertility since by keeping infant loss high, it buttresses one of the major obstacles to the adoption of family planning. Secondly, it can work to increase fertility directly by decreasing the length of the birth interval through the removal of the inhibitory influence of lactation upon ovulation. Such decreases in the birth intervals in turn would have a negative effect on survival chances of both the child born at the end of the short interval for predominantly prenatally determined reasons, and on the child born at the beginning of the interval due to the necessity of his being abruptly weaned and the consequent possible development of kwashiorkor, infection, and death.

It is obvious from the above example that it is necessary to look for intervening variables in general relationships, and the mechanism of change so that both positive and negative influences at work can be more fully evaluated and their broader implications understood. Hunter and Hughes[31] have reviewed an overwhelming amount of evidence that 'development' has led to the increase and diffusion of disease in Africa because the implications of various development programs were never drawn out beyond their immediate situations. An example of this from the present was the high rates of death over age 5 in Ghana. While these data must be interpreted with caution as no upper limit to the age group is supplied, the possibility that

some new disease patterns may be emerging deserves considerable attention, for it calls for corrective programs in Ghana and preventive programs in countries where women are beginning to use malarial prophylaxis for their infants.

Finally, the latter finding as well as the general discussion of the role of malnutrition is disease and death in West Africa underlines the crucial need for coordination of programs aimed at improving the condition and chances of life developing countries. In turn, in order to better coordinate programs and to understand their possible impact on other aspects of the situation around them, future studies must stress interrelationships between economic, demographic, and social phenomenon through discussions and investigations of intervening variables and mechanisms of change.

FOOTNOTES

1. This is discussed fully in J.A. Harrington. "The Effect of High Infant and Childhood Mortality on Fertility: The West African Case," Concerned Demography, Fall 1971, Vol. 3 No. 1

2. See P. Cantrelle, et. al. "Mortalité de l'Enfant au Sénégal," Les Conditions de Vie de l'Enfant en Milieu Rural en Afrique, Dakar, 1967, Centre International de l'Enfance, Réunions et Conférences XIV, Dakar, pp. 128-148.

3. M.I. Ogbeide. "The Relative Merits of Preventive and Curative Services in the Maintenance of Health and Nutrition in the Rural African Child," Les Conditions de Vie de l'Enfant en Milieu Rural en Afrique, 1967, p. 289.

4. John E. Gordon and Nevin S. Schrimshaw. "Infectious Diseases in the Malnourished," Current Concepts in Clinical Nutrition, S.L. Halpern (ed.), The Medical Clinics of North America, Vol. 54 No. 6, Nov. 1970, p. 1498.

5. In the present study the lengths of lactation ranged from under one year to over 3 years.

6. D.B. Jelliffe. "Culture, Social Change and Infant Feeding: Current Trends in Tropical Regions," American Journal of Clinical Nutrition, Vol. 10, January 1962, p. 34.

7. Ibid, p. 37.

8. Ibid, p. 37.

9. Ibid, p. 36.

10. D.B. Jelliffe. Infant Nutrition in the Subtropics and Tropics. W.H.O. Mongraph Series #29, Geneva, 1955, p. 67.

11. J. Chavenon-Rasoazanapara. "Education de la Mère en Matière d'Alimentation de l'Enfant de 0 à 6 Ans en Afrique au Sud du Sahara," Seminaire sur l'Education en Matière de Santé et de Nutrition en Afrique au Sud du Sahara, organisé conjointement par la C.C.T.A. et le C.I.E. avec la collaboration de l'O.A.A., l'OMS, l'UNESCO, et l'aide du FISE, Pointe-Noire, 1962, pp. 36-37.

12. R.G. Hendrickse. "Major Causes of Death in Infancy and Early Childhood at University College Hospital, Ibadan, (Nigeria)," Les Conditions de Vie de l'Enfant en Milieu Rural en Afrique, Dakar, 1967, p. 123.

13. Ogbeide, Ibid.

14. See discussion in J.A. Harrington. A Comparative Study of Infant and Childhood Survivorship in West Africa. Ph.D. Thesis, Cornell University, 1971, p. 43-52. The evaluation of data accuracy was made on the basis of:
    a) sex ratios at birth and of survivors (Upper Volta only)
    b) comparison of Upper Volta sex ratios with those found in a comparable Turkish study (Arjun L. Adlakha, A Study of Infant Mortality in Turkey, Ph.D. Thesis, University of Michigan, 1970)
    c) comparison of age pattern of mortality with that found in the Senegal studies (Cantrelle, et. al.)
    d) consistency of the trends over the 9 samples
    e) by comparison of survey results with the respective 1960 round of census data.

15. See D.I. Pool. "A Note on a Demographic Survey for the Study of Factors Affecting Fertility in Ghana," Africa, Vol. XXXVII, No. 3, July, 1967; D.I. Pool, et. al. "Enquête Sur la Fécondité et la Famille au Niger: Méthodologie," Collections Méthodologiques, No. 1, C.N.R.S.H., Niamey, 1970; D.I. Pool and Victor Piché. "Enquête Sur la Fécondité au Niger Central," Collections Méthodolgiques, No. 2, C.N.R.S.H., Niamey, 1971; D.I. Pool. "Preliminary Report on a Ghanaian Fertility Survey," The Population of Tropical Africa, 1968; and D.I. Pool. "Ghana Fertility Survey," in Dem. Div. Population Council, (ed.), Slected Questionnaires in Knowledge, Attitudes and Practice of Family Planning, New York, Vol. 1, 1967.

16. T. McKeown and R.C. Record. "Reasons for the Decline of Mortality in England and Wales During the Nineteenth Century," Population Studies, Vol. XVI, 1962-63, pp. 94-122.

17. P. Cantrelle, et. al. "Mortalité de l'Enfance dans la Region de Khombole-Thienaba," Conditions de Vie de l'Enfant en Milieu Rural en Afrique, Dakar, 1967.

18. Davis, K. and Blake, Judith. "Social Structure and Fertility: An Analytical Framework," Economic Development and Cultural Change, IV, 3 (April 1956), pp. 221-235.

19. See Harrington op. cit. pp. 67-70. The chief problems discussed in this regard are the following:
    1. Lactation index - an inability to determine sequence of weaning and death of child from available data.
    2. Medical Care Index - Actual Care Received: did not refer to the care received by a child in any illness but rather by his mother; relied on experience of one illness and one pregnancy while it is known that illness is a life cycle variable; care sought is a function of type of illness; Care Desired: difficult to establish that stated desires have anything to do with what Respondent would actually do in any situation.
    3. Water and Sewage Facilities - difficult to separate out effects of facility itself from level of development or standard of living they also reflect.

20. Leonard Plotnicov. Strangers to the City: Urban Man in Jos, Nigeria. University of Pittsburgh Press, 1967, pp. 20-21.

21. For discussion of common age errors in African data see: Etienne Van de Walle. "Characteristics of African Demographic Data," in the Demography of Tropical Africa, Princeton (1968), pp. 72-79.

22. See John M. Hunter. "Population Pressure in a Part of the West African Savanna: A Study of Nangodi, Northeast Ghana," Annals of the Association of American Geography, Vol. 57, No. 1, March, 1967.

23. The survey data indicated by both cohort analysis and comparative analysis with 1960 census results an improvement in mortality conditions in early childhood over the past decade. See J.A. Harrington and D.I. Pool. "Patterns of Survivorship in Niger and Upper Volta." Paper presented at I.U.S.S.P. Africa Regional Population Conference, Accra, Ghana, December 1971. This paper has been revised and extended to include the Ghanaian results as well. The resulting paper, "Differentials and Trends in Infant and Childhood Survivorship in Ghana, Upper Volta and Niger," (J.A. Harrington-Soremekun and D.I. Pool) has been submitted for publication to Demography.

24. See John M. Hunter. "Seasonal Hunger in a Part of the West African Savanna: A Survey of Body-Weights in Nangodi, North East Ghana," Transactions and Papers, University of Durham, 1967, Publication No. 41.

25. R.G. Hendrickse. "Major Causes of Death in Infancy and Early Childhood at University College, Ibadan," in Les Conditions de Vie de l'Enfant en Milieu Rural en Afrique, Dakar, 1967, p. 124.

26. Ibid, p. 124.

27. See description of distribution of malarial mosquitoes in Africa in R. Mansel Prothero. Migrants and Malaria, London, 1965, pp. 13-14.

28. J.A. Harrington and D.I. Pool, op. cit.

29. See J.A. Harrington, op. cit. There the structure of the analysis is presented in the following manner:
    a) infant and childhood survivorship patterns by the intervening variables (lactation, medical care, and water and sewage facilities)
    b) differential distribution of the intervening variables over the 3 social groups (education; religion and type of marital union)
    c) social differentials in survivorship (including tables simultaneously controlling for age of mother and this social variable, i.e., education and religion)

    The tables presented in each of these three sections are not all presented here due to their length and detail.

30. See C.L. Ford. A Comparative Study of Human Reproduction. Yale University Publications in Anthropology, No. 32, New Haven, 1945 and 1964, p. 77 cited by Pierre Pradervand. "Some Relationships of Parity, Spacing and Family Size on Maternal and Child Health, With Special Reference to Tropical Africa," Center for Population Planning, University of Michigan, School of Public Health, December 1964, p. 42.

31. John M. Hunter and Charles C. Hughes. "Disease and Development in Africa," Social Science and Medicine, Col. 3, 1970, pp. 443-493.