SPATIAL VARIATIONS IN INFANT AND CHILD MORTALITY LEVELS IN SIERRA LEONE

By

Borbor Sama KANDEH*

ABSTRACTS

The general research objectives of this project were to calculate and map levels of infant, child and adult mortality in the administrative districts of Sierra Leone using 1974 census data, followed by a correlational analysis of these levels with certain key social variables. These were the distribution of medical facilities, the distribution of the population with no formal schooling and malaria endemicity by district. The results showed an estimated infant mortality rate of 215 in 1971 for Sierra Leone. The proportion of children dying before their fifth birthday was pegged at .3582 also for 1971. In relation to other African Countries, Sierra Leone was in the category of countries with very high infant and child mortality levels.
Infant and child mortality levels in the administrative areas of Sierra Leone were in general very high but in addition showed some differences in levels. Only the Western Area had an infant mortality rate below 160 in 1971. The highest infant mortality rate was in Pujehun District (272). The pattern is the same when one examines the proportion of children dying before their fifth birthday, with the Western Area having the lowest (.2630) and Pujehun District having the highest (.4431). Attempts at explaining the regional variation in mortality levels by the distribution of health facilities, the percentage of the population with no formal schooling and malaria endemicity failed to provide any significant results once the Western Area was excluded from the analysis.

* Dean, Faculty of Education, Njala University College, University of Sierra Leone, P.M.B., Freetown, Sierra Leone.

INTRODUCTION

Sierra Leone is a small country of about 28,000 square miles which lies on the South West coast of West Africa between latitudes 6.55 and 10.0 N and between longitudes 10.16 and 13.18 W <1>.

For such a small country, Sierra Leone has a varied relief wich ranges from coastal swamps to the highest mountain (Bintumani 6,390 feet) in West Africa west of Mount Cameroon. Over half of Sierra Leone lies below 500 feet and of the remainder, more than one quarter is between 1000 and 2000 feet. The area of land above 2000 ft is small (2.46% of the land area). The approximate average height of Sierra Leone is 617 feet above sea level.

There are two major seasons, the dry season (December to April) and the rainy season (May to November). The mean daily temperatures range from a maximum of 95 F or more in the central parts of Sierra Leone in March, to a minimum of 60 F or less in the northern mountainous regions during the month of January. The mean annual rainfall over most of the central two thirds of the country is between 100 and 120 inches. The coastal belt has rainfall ranging from 130 to 170 inches and over the rainfall ranging from 130 to 170 inches and over the peninsular mountains where Freetown is located, rainfall values increase to more than 200 inches. In general rainfall tends to decrease from the coast inland and eastwards. The vegetation of most of the country which was formerly forest has been greatly reduced to secondary forest and farm bush due largely to the bush fallowing system of farming. The other types of vegetation are the grasslands of the northern plateaux region, coastal lowlands and riverain grasslands and mangrove swamps along the coast.

Sierra Leone's demographic picture is gradually falling into place with the information provided by the last three censuses (1963, 1974 and 1985). The provisional results of the 1985 census showed a total population of 3,515,812 persons. When the unadjusted population totals for 1963 (2,180,355), 1974 (2,735,159) and 1985 are compared, the resulting average annual intercensal growth rate is 1.9 per cent for 1963-1974 and 2.3 percent for 1974-1985. The age structure of the population, according to the 1974 census results, is youthful with over 35 per cent of the population less than 15 years of age. Only 5 per cent of the population is 65 years and over in age. The estimated crude birth rate for the country is 48.7 per 1000. Mortality levels are also quite high with an estimated crude death rate of 28 per 1000 <2>.

Sierra Leone has four major administrative units, the Western Area, the Southern Province, the Eastern Province and the Northern (Figure 1.). Each of the three provinces is divided into districts which total twelve and which are in turn subdivided into chiefdoms which number 148. The Western Area is also divided into four very small rural districts and the capital city of Freetown but its local government patterns are very different from that seen in the three provinces.

METHODOLOGY

The collection and analysis of data for this study was done at both macro and micro levels. This paper is based on the macro-level data, using aggregates for administrative districts.

The information on mortality collected by the 1974 census was the data base for this analysis. It consisted of reports of children ever born/surviving for women aged 15-49 years of age who were distributed into five year age groups. This information was available for all the administrative areas of the country which included chiefdoms, districts and provinces. The information was then used to obtain estimates of the probability of dying between birth and certain exact childhood ages (qx) using the Trussel variant of the Brass technique. The results were further used to obtain infant mortality rates from Regional Model Life Tables <3>.

After infant mortality rates had been estimated for all the administrative districts the mortality rates were compared with the distribution of three factors which it was felt would have some influence on infant and child mortality, to see whether explanations for the observed patterns of mortality could be found at this macro level. These were the distribution of medical facilities, the distribution of the population with no formal schooling and malaria endemicity by district.

FIGURE 1

REGIONAL VARIATIONS IN MORTALITY LEVELS

In Table 1 is shown the proportion of dead children distributed by age of the woman and district of enumeration. Taking the proportion of children dead to women aged 20-24 years of age, the lowest value is in Freetown (.2208) and the highest is in Pujehun District (.4328). The second lowest value is in the Western Area, where Freetown the capital city is located (.2271), and the second highest is in Kenema District (.3844). The same pattern is also maintained when one looks at the proportion of dead children to women aged 45-49 years with much higher proportions, as follows, Freetown (.3374), Western Area (.3500), Pujehun District (.5272) and Kenema District (.5164).

TABLE 1. PROPORTION OF DEAD CHILDREN BY AGE OF WOMAN AND ADMINISTRATIVE AREA.

AREA	AGE OF WOMAN						
	15-19	20-24	25-29	30-34	35-39	40-44	45-49
SIERRA LEONE	.3150	.3348	.3600	.3938	.4112	.4442	.4601
WESTERN AREA	.2068	.2271	.2531	.2761	.2984	.3194	.3500
Freetown	.2049	.2208	.2433	.2670	.2870	.3047	.3374
Western Rur :	.2222	.2766	.3221	.3327	.3590	.3914	.4016
SOUTHERN PROV	.3531	.3778	.3999	.4293	.4436	.4743	.4812
Bo	.3626	.3732	.4002	.4285	.4444	.4749	.4882
Bonthe	.3180	.3470	.3676	.3904	.4317	.4465	.4528
Moyamba	.3277	.3649	.3855	.4121	.4242	.4555	.4611
Pujehun	.3958	.4328	.4497	.4819	.4822	.5205	.5272
Sherbro Urb :	.2057	.3149	.2975	.3537	.4121	.4090	.3898
EASTERN PROV	.3329	.3460	.3694	.4053	.4241	.4548	.4710
Kailahun	.3195	.3365	.3673	.3996	.4146	.4425	.4631
Kenema	.3607	.3844	.4012	.4416	.4672	.5025	.5164
Kono	.3182	.3218	.3455	.3730	.3806	.4084	.4225
NORTHERN PROV	.3049	.3331	.3584	.3906	.4068	.4448	.4657
Bombali	.3064	.3276	.3547	.3862	.3968	.4392	.4579
Kambia	.2838	.3206	.3510	.3856	.4050	.4386	.4716
Koinadugu	.3161	.3337	.3553	.3785	.3968	.4253	.4341
Port Loko	.2816	.3134	.3450	.3761	.4025	.4403	.4628
Tonkolili	.3443	.3773	.3900	.4252	.4297	.4730	.4908

The above information has been used to provide estimates of infant and child mortality for the districts and the information is shown in Table 2. According to this information in Table 2., Sierra Leone had an infant mortality rate of 215 in 1971. The proportion of children dying before their fifth birthday was pegged at .3582 also for 1971. In relation to other African Countries, Sierra Leone was in the category of countries with very high infant and child mortality levels <4>.

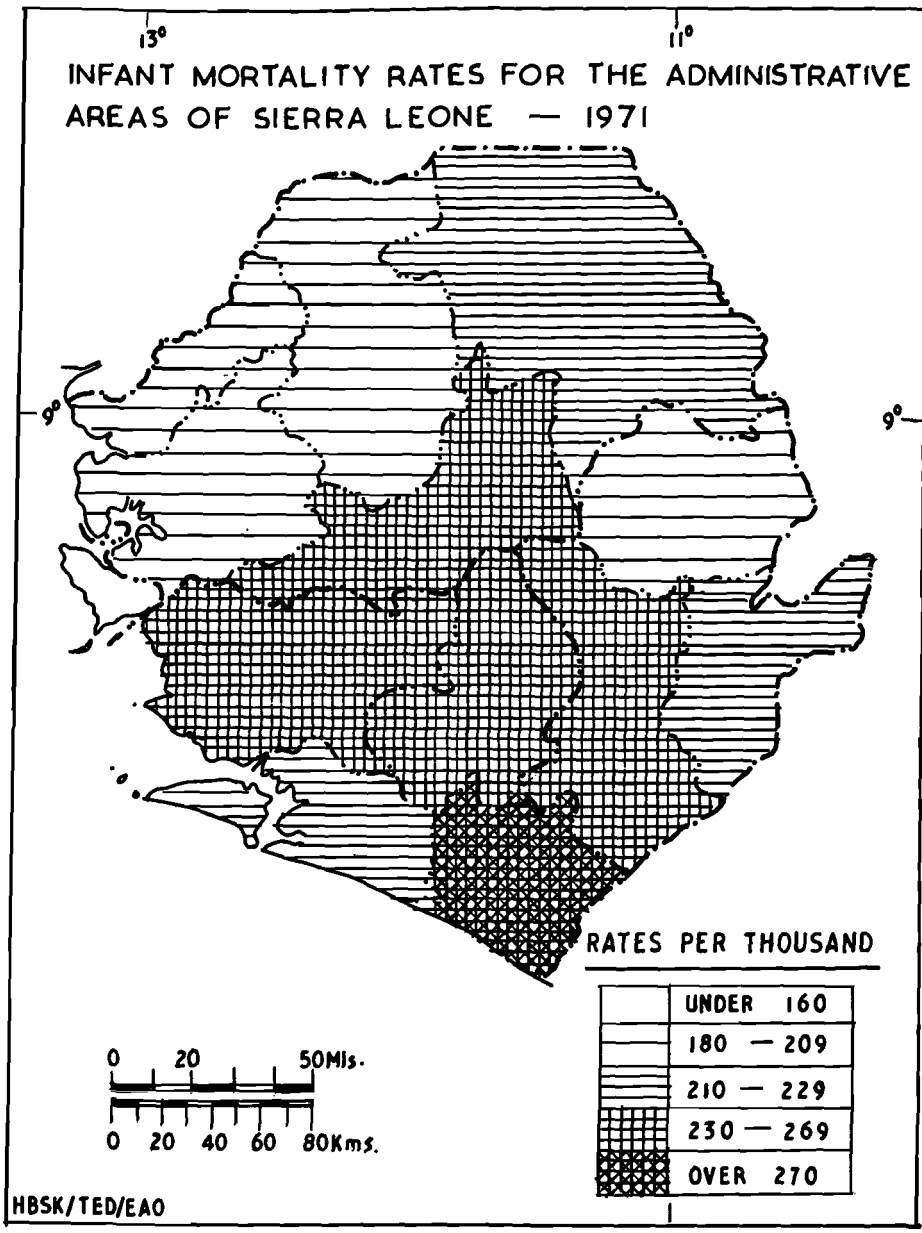
The administrative areas of Sierra Leone in general showed very high levels of infant and child mortality (Table 2. and Figure 2.). Only the Western Area had an infant mortality rate below 160 in 1971 (Western Area = 156, Freetown = 152 and Western Rural Area = 186). These represented the lowest rates for the entire country in 1971. The highest infant mortality rate was in Pujehun District (272), the second highest in Tonkolili District (244) and the third highest is shared by Bo (241), Kenema (241) and Moyamba (242) Districts. The remaining districts had infant mortality rates ranging from 197 (Port Loko) to 221 (Sherbro Urban District). The pattern is again similar when one examines the proportion of children dying before their fifth birthday, with the Western Area having the lowest (.2630) and Pujehun District having the highest (.4431).

TABLE 2. PROPORTION OF CHILDREN DYING BETWEEN BIRTH AND CERTAIN EXACT CHILDHOOD AGES (Q VALUES FOR ML (X)) FOR THE VARIOUS ADMINISTRATIVE AREAS OF SIERRA LEONE BASED ON THE NORTH MODEL. 1971. (Derived from q2)

AREA	Q (1)	Q (2)	Q (3)	Q (5)
SIERRA LEONE	.2152	.2743	.3105	.3582
WESTERN AREA	.1556	.1999	.2270	.2627
Western Rur :	.1861	.2384	.2704	.3125
Freetown	.1516	.1948	.2212	.2561
SOUTHERN PROVINCE	.2427	.3077	.3475	.4000
Sherbro Urb :	.2208	.2812	.3181	.3668
Pujehun District	.2721	.3428	.3861	.4431
Moyamba "	.2415	.3063	.3459	.3982
Bonthe "	.2130	.2717	.3075	.3548
Bo "	.2405	.3051	.3446	.3967
EASTERN PROVINCE	.2194	.2795	.3162	.3647
Kono District	.2041	.2607	.2953	.3409
Kenema "	.2406	.3052	.3447	.3968
Kailahun "	.2179	.2776	.3141	.3623
NORTHERN PROVINCE	.2123	.2708	.3065	.3537
Tonkolili Dist	.2439	.3092	.3492	.4018
Port Loko "	.1973	.2523	.2859	.3302
Koinadugu "	.2200	.2802	.3170	.3656
Kambia "	.2033	.2597	.2942	.3397
Bombali "	.2053	.2622	.2970	.3428

The distribution of infant and child mortality rates will now be compared with the distribution of the three variables to provide some explanation for the regional contrasts in levels of infant and child mortality. The three variables are the distribution of medical facilities, the distribution of the population with no formal schooling and malaria endemicity. The information for the infant mortality rates and the three variables do not all refer to the same year but in fact cover the period 1971 to 1980. There is no evidence of a significant decline in infant and child mortality during this period if the information from the vital registration system whose results are reliable for the Western Area are examined. For example the infant mortality rate in 1970 for the Western Area was 136.5, in 1976 it was 117.5 and in 1980 it was 124.7 <5>.

FIGURE 2



Furthermore the intercensal growth rate as presented earlier on was 2.3% for the 1974-1985 period, only a slight increase over the previous intercensal growth rate of 1.9% for the 1963-1974 period, suggesting only slight improvements in the mortality situation in the country. There is also no reason for expecting significant changes in the distribution of the three variables within the 1971-1980 period.

FORMAL SCHOOLING

The distribution of the total population with no formal schooling by district is shown in Table 3. The Western Area has the lowest percentage (27.2%) and Koinadugu District the highest (93.63%). When Tables 2 and 3 are compared, only the Western Area, where the percentage of the population with no formal schooling is very low (27.2%), shows the expected relationship between education and the level of infant mortality which should be an inverse relationship (the higher the level and percentage of educated people, the lower the level of infant mortality). For the remaining districts the distribution of the population with no formal schooling does not explain the distribution of infant mortality levels. In most instances in fact the reverse effect is shown. For example Koinadugu District where 93.63 percent of the population 5 years and above have had no formal schooling has a lower infant mortality rate (220) than Bo District where the percentage of the population with no formal schooling is 78.77 percent and the infant mortality rate is 240 per 1000 live births.

TABLE 3. THE PERCENTAGE DISTRIBUTION OF THE POPULATION WITH NO FORMAL SCHOOLING BY ADMINISTRATIVE AREAS. 1974

ADMINISTRATIVE : AREA	PERCENTAGE
SIERRA LEONE	80.95
WESTERN AREA	27.20
SOUTHERN PROVINCE	81.80
Bo	78.77
Bonthe	82.73
Moyamba	82.22
Pujehun	86.70
EASTERN PROVINCE	82.76
Kailahun	82.71
Kenema	82.33
Kono	83.14
NORTHERN PROVINCE	89.28
Bombali	87.87
Kambia	92.21
Koinadugu	93.63
Port Loko	88.47
Tonkolili	86.42

PRESENCE OF HEALTH FACILITIES

The health facilities managed by the Sierra Leone Government, which constitute at least 75 per cent of all health facilities, are organised in a heirarchy with provision for referrals from the lowest unit to the highest. At the bottom of this heirarchy are the health centres and dispensaries within certain chiefdoms and the Western Area. Next in the heirarchy are the district hospitals with at least one Medical Officer. These hospitals are located in the district headquarters. Next are the provincial hospitals located in Bo, Kenema and Magburaka. Finally at the top are the National Referral Hospitals like Connaught Hospital, Princess Christian Maternity Hospital, Children's Hospital, the Lakka Chest Hospital and the Kissy Mental hospital all but one of which are located in the Western Area. The most qualified, competent and longest serving health professionals are located in these hospitals in the Western Area.

The Non-Governmental health facilities do not follow this pattern but are instead randomly distributed predominantly in Kono, Kenema, Kailahun, and Port Loko Districts and the Western Area. Such hospitals include the NDMC hospital at Yengema (Kono district), Catholic hospital at Serabu (Bo district), Nixon Memorial hospital at Segbwema (Kailahun district), Bai Bureh Memorial hospital at Mahera (Port Loko district) and the Netland Nursing Home in Freetown (Western Area). Against this background it would appear that the most favoured administrative areas are the Western Area, Port Loko, Tonkolili, Bombali, Kenema, Bo, Kailahun and Kono Districts. The less favoured areas include the remaining districts of Koinadugu, Kambia, Moyamba, Bonthe and Pujehun.

The distribution of health facilities and personnel by administrative area in 1980, is shown in Table 4. The distribution of the number of persons per Nurse/Midwife shows the Western Area with the lowest ratio (1000 persons per Nurse/Midwife) and Kambia District with the highest (27,000 per Nurse/Midwife). The number of persons per hospital again shows the Western Area with the lowest (38,000 per hospital) and Tonkolili District with the highest (221,000 per hospital). Finally in terms of the average distance travelled to a hospital in kilometres, the Western area has the shortest distance (7.4 kms) whilst Koinadugu District has the longest (109.4 kms).

TABLE 4. DISTRIBUTION OF HEALTH FACILITIES AND PERSONNEL BY ADMINISTRATIVE AREA : 1980

ADMIN. AREA	A	B	C	D	E	F
SIERRA LEONE	45	4	1.00	73	40.2	22
WESTERN AREA	647	1	2.86	38	7.4	5
Western Rur :	85					
Freetown	4117	1	2.89	34	2.9	4
SOUTHERN PROV	33	5	0.97	72	46.5	32
Bo	44	4	1.32	115	50.8	18
Bonthe	27	4	1.22	46	41.4	47
Moyamba	30	7	0.82	101	41.3	51
Pujehun	30	15	0.38	122	63.7	121
EASTERN PROV	64	7	0.62	81	35.8	44
Kailahun	51	4	0.62	49	30.9	28
Kenema	51	5	0.95	76	38.7	38
Kono	86	14	0.41	119	37.3	68
NORTHERN PROV	32	9	0.65	104	56.8	57
Bombali	33	1	0.52	130	62.8	52
Kambia	54	27	0.30	165	55.4	164
Koinadugu	15	16	0.51	178	109.4	89
Port Loko	57	5	1.00	53	30.7	35
Tonkolili	32	12	0.61	221	83.2	73

KEY

A = Number of persons per square kilometre
B = Number of persons per Nurse/Midwife (,000)
C = Number of Hospital beds per 1000 persons
D = Number of persons per Hospital (,000)
E = Average distance travelled to a Hospital (Kilometres)
F = Number of persons per Physician (,000)

A comparison of the infant and child mortality estimates in Table 2. with the distribution of health facilities and personnel in Table 4. will provide the opportunity for examining how far the presence of these facilities affects the regional pattern of infant and child mortality. The infant and child mortality estimates that are being used for the comparison are for 1971. They are being used because of the non-availability of more recent estimates for all the administrative areas. The information on health establishments is for 1980, but there is no reason to believe that the distribution of these facilities in 1971 was vastly different from that in 1980. From the information shown in Tables 2 and 4, one can see that except for the Western Area, there is no significant relationship between the presence of health facilities as shown by the number of inhabitants per health unit, the number of hospital beds per 1000 inhabitants, the number of inhabitants per hospital and the average distance travelled to a hospital and the level of infant and child mortality. For example Pujehun district with the lowest ratio of hospital beds per 1000 inhabitants (0.38) has the highest infant mortality rate (272). The ratio for Kono district (0.41) is only slightly higher than that for Pujehun yet the infant mortality rate for Kono district is even lower than that for districts like Bo (with a provincial hospital and an infant mortality rate of 240) and Bonthe (with an infant mortality rate of 213), both of which have higher hospital beds/population ratios (Bo = 1.32 and Bonthe = 1.22), than Kono district. Again when one looks at the average distance travelled to a hospital, and one excludes the Western Area, there is no consistent relationship when one compares Koinadugu and Pujehun districts. In Pujehun District the average distance to the only hospital was 63.7 kilometres while in Koinadugu District the average distance travelled again to the only hospital is 109.4 kilometres. Even then the infant mortality rate for Koinadugu (220) is much lower than that for Pujehun (272).

MALARIA ENDEMICITY

The Ministry of Health in collaboration with the World Health Organisation carried out malariometric surveys in all twelve districts, the Western Area and the Bombali Primary Health Care Pilot project area from 1976 to 1979 <6>. The findings from this survey are shown in Tables 5. and 6. All the malariometric surveys were done at the same time of the year from January to March in the three year period. Crude parasite rates varied from an overall rate of 31.9 percent to 81.5 percent and age specific rates in the 2-9 years age

group varied from 35.3 percent to 81.5 percent. As a result the country was classified as a hyper to holo-endemic area. Gametocyte rates ranged from 3.2 to 28.1 percent indicating high infective capacity. Spleen rates examined ranged from 22.6 to 63.3 percent. In terms of the prevalence by district the highest parasite and spleen rates were found in Kailahun, Kenema, Pujehun and Tonkolili Districts which produced over 70 percent prevalence rates.

When the information in Tables 5 and 6 is compared with the infant and child mortality rates in Table 2, malaria endemicity does not singularly explain the variations in infant and child mortality levels. For example when one looks at the crude parasite rates among 2-4 year olds in Table 5, the highest rates are in Kailahun (82.4%) and Kenema (82.3%) Districts whereas Pujehun District has a rate of 59.6 percent. In effect one could not therefore conclude that a particular district or region was hyper endemic and that this was largely responsible for the very high infant and child mortality rates.

TABLE 5. SUMMARY OF THE RESULTS OF MALARIOMETRIC SURVEYS CARRIED OUT IN SIERRA LEONE DURING THE PERIOD 1976-1979.

ADMIN. AREA	A	B	C	D	E	F	G
WESTERN AREA	1000	518	51.8	57.1	69.3	15.6	27.0
Freetown							
Western Rur :							
NORTHERN PROV							
Bombali	1900	1171	61.5	69.8	71.3	11.9	16.3
Bombali PHCA	400	326	81.5	95.0	84.8	28.0	29.8
Kambia	1200	655	54.6	56.1	78.6	21.3	25.8
Koinadugu	1600	817	51.0	53.4	59.0	4.6	10.5
Port Loko	1750	1199	68.5	71.2	78.2	21.9	29.1
Tonkolili	1650	1084	65.7	68.0	77.8	21.8	28.4
SOUTHERN PROV							
Bo	1696	927	54.6	66.0	64.8	10.0	1.6
Bonthe	1000	435	43.5	43.3	56.0	3.2	6.0
Pujehun	1500	967	64.4	59.6	80.6	12.4	14.4
Sherbro Urb :							
EASTERN PROV							
Kailahun	2100	1494	71.1	82.4	80.6	16.9	16.4
Kenema	1800	1319	73.2	82.3	82.1	23.8	16.8
Kono	1800	1009	56.0	58.5	67.4	7.7	10.3

KEY

A = Blood slides taken
B = Blood slides positive
C = Crude parasite rate
D = Range of parasite rate among 2-4 year olds
E = Range of parasite rate among 5-9 year olds
F = Overall Gametocyte rate
G = Overall heavy infection rate
PHCA = Bombali District Primary Health Care Area

TABLE 6. SUMMARY OF THE RESULTS OF MALARIOMETRIC SURVEYS CARRIED OUT IN SIERRA LEONE DURING THE PERIOD 1976-1979.

ADMIN. AREA	A	B	C	D	E	F
WESTERN AREA	914	277	30.7	35.7	47.9	1.55
Freetown						
Western Rur:						
NORTHERN PROVINCE						
Bombali	1366	597	43.7	51.1	55.2	1.48
Bombali PHCA	366	200	54.6	69.2	65.2	1.58
Kambia	1076	243	22.6	25.3	39.7	1.97
Koinadugu	1533	885	57.7	84.3	84.1	1.84
Port Loko	1616	479	29.6	32.8	43.1	1.97
Tonkolili	1492	480	32.2	42.4	49.6	2.09
SOUTHERN PROVINCE						
Bo	1614	1022	63.3	76.8	85.2	1.51
Bonthe	957	507	53.0	65.7	74.3	1.47
Pujehun	1446	790	54.6	61.7	81.5	1.49
Sherbro Urb:						
EASTERN PROVINCE						
Kailahun	1939	1040	53.6	65.0	74.9	1.46
Kenema	1665	946	56.8	71.6	77.6	1.77
Kono	1666	727	43.6	46.7	64.3	1.45

KEY

A = Spleen examined
B = Spleen positive
C = Spleen rate %
D = Range of spleen rate among 2-4 year olds
E = Range of spleen rate among 5-9 year olds
F = Average enlarged spleen
PHCA = Bombali District Primary Health Care Area

DISCUSSION

The results of the analysis of the three factors (Formal Schooling, Health Facilities and Malaria Endemicity) in general therefore did not explain the spatial variation in infant and child mortality levels. In the case of education this does not however mean that the level of education does not have any effect on the infant mortality rate in Sierra Leone. The results simply suggest that at the macro level of analysis, education was not seen to have the expected effect. This is due to the fact that when the Western Area is excluded from the analysis the range between the remaining districts is very small (78.7 - 93.6%),

because of the high percentage of the population with no formal schooling in all the districts. So that even though this low level of education in the provinces might be a contributory factor to the high levels of infant mortality in the provinces, it does not adequately explain for example why Pujehun District has a higher level of infant mortality than Koinadugu District. Micro-level studies which have been restricted to localities in the provinces, have consistently shown however that the level of education especially mother's education has the greatest effect on the level of infant mortality. For example Kandeh <7> in a study of Bo and four other chiefdom headquarters in the Bo District found out that 13.8 percent of the children whose mothers had no formal schooling died in infancy while only 6.9 percent of those whose mothers had post-secondary education, died within the same period. The results of the 1974 census showed that the educational level of the mother is a highly significant factor in the level of infant and child mortality. The mortality levels were lowest for children whose mothers had secondary or higher education followed by those whose mothers had only primary education. Children whose mothers had no education at all or whose mother's educational level was not stated experienced the highest childhood mortality. The probability of dying within the first two years of life decreased progressively from 0.2921 for children of mothers with no education to 0.1400 for children whose mothers had secondary or higher education - a decline of over 50 per cent. <8>. The results of a 1980 comparative mortality survey in Sierra Leone also showed that attending secondary school will reduce child mortality levels by about 8 percent over women with no schooling. Fathers education did not show any meaningful relationship when fathers with no education were compared with fathers in other education categories <9>. These results confirm what was found in each of the 28 countries covered by the World Fertility Survey where both infant and child mortality decreased consistently with increasing parental education <10>.

Explanations for the significance of maternal education in decreasing child mortality have revolved around (a) the break with tradition as parents become less fatalistic, (b) the ability of educated mothers to better manipulate facilities in the modern world and (c) the fact that education alters the traditional balance of power in the family of procreation in favour of the woman with the consequence that she can take more active part in the decision making process, with profound effects on child care <11>.

The absence of a significant relationship between infant and child mortality and the presence of health facilities is probably due to the low user effectiveness of these establishments either because of high treatment and transport costs and/or the non-availability of drugs. This therefore suggests that the present health delivery system which is largely institution based and requires movement over long distances by the population is not effective and has not been able to tackle the problem of infant and child mortality specifically and health in general. Serious efforts should therefore be made to explore new ways of effective health delivery for the people. The present system as it operates has produced a lot of complaints from patients, doctors and hospital administrators. Frequently hard complaints are the absence of essential drugs in the hospitals, obsolete equipment, inadequate financing of the health sector by the Sierra Leone Government and deteriorating working conditions for Doctors and Nurses. And as conditions in the government operated health establishments have steadily declined we are witnessing a mushrooming of privately owned and operated drug stores, health centres and private hospitals whose prices are out of the reach of the average individual. The practice of medical evacuation for high level government employees is an increasing phenomena since the local hospitals lack the essential equipment to carry out such basic operations. The promise seems to lie in Primary Health Care (PHC). As recently as 1984, the Bombali PHC programme in Makeni was providing evidence to show that the intervention strategy adopted by the programme was yielding dividends by reducing infant mortality levels. The programme has been in operation since 1978. Its activities hinge on community participation through village/section/chiefdom health committees which recommend personnel for training ; constant monitoring and emphasis on aspects such as immunisation, environmental health, training of traditional birth attendants, simple malaria eradication and health education. The apparent successes of the Bombali PHC programme imply that at relatively low cost and with greater community participation there is the possibility of reducing the current high levels of infant and child mortality if more stress is put on preventive care and out-reach programmes rather than the present emphasis on curative care based only on institutions.

Malaria endemicity does not also singularly explain the variations in infant and child mortality levels. For example when one looks at the crude parasite rates among 2-4 year olds, the highest rates are in Kailahun (82.4%) and Kenema (82.3%) Districts whereas Pujehun District has a rate of 59.6 percent. In effect one could not therefore conclude that a particular district or region

was hyper endemic and that this was largely responsible for the very high infant and child mortality rates. This finding also still leaves unexplained the regional variations in infant and child mortality levels in Sierra Leone. Even at the micro-level analysis, the examination of several socio-economic and environmental variables failed to adequately explain the reasons for the regional variations. The results only further confirmed the existence of differences in mortality levels in the country <12>.

CONCLUSION

Infant and child mortality levels in the administrative areas of Sierra Leone were in general very high but in addition showed some differences in levels. Only the Western Area had an infant mortality rate below 160 in 1971. The highest infant mortality rate was in Pujehun District (272). The pattern is again similar when one examines the proportion of children dying before their fifth birthday, with the Western Area having the lowest (.2630) and Pujehun District having the highest (.4431).
When the distribution of infant mortality rates for the districts (excluding the Western Area) is compared to the distribution of the population with no formal schooling by district, there is no relationship between the two. In most instances in fact the reverse effect is shown. For example Koinadugu District where 93.63 percent of the population 5 years and above have had no formal schooling has a lower infant mortality rate (220) than Bo District where the percentage of the population with no formal schooling is 78.77 percent and the infant mortality rate is 240 per 1000 live births.

With regard to the distribution of health facilities the results again show that except for the Western Area, there is no significant relationship between the presence of health facilities as shown by the number of inhabitants per health unit, the number of hospital beds per 1000 inhabitants, the number of inhabitants per hospital and the average distance travelled to a hospital and the level of infant and child mortality.
Malaria endemicity does not also singularly explain the variations in infant and child mortality levels. One could not conclude that a particular district or region was hyper endemic and that this was largely responsible for the very high infant and child mortality rates.

This still leaves unexplained, the reasons for the regional variations in infant and child mortality levels in Sierra Leone.

ACKNOWLEDGEMENTS

I am extremly grateful to the Ford-Rockfeller Population and Development Research Program for providing the grant to carry out this research project. I also appreciate the financial assistance provided by the UNICEF program in Sierra Leone and the Population Council. Many thanks to Prof. Thomas Dow, Jr of SUNY at Purchase, New York for his invaluable comments on the draft of this paper. Mr. Okine of the Department of Geography and Environmental Studies, Njala University College, drew the maps.

REFERENCES

1. J.I. CLARKE, ed. **Sierra Leone in Maps.** London, University of London Press, 1969

2.(a) C.S. OKOYE **An Evaluation of the Age and Sex Data of the 1974 Population Census of Sierra Leone.** Census Analysis Vol.1. Central Statistics Office, Freetown. 1979

(b) C.S. OKOYE **An Analysis of the Mortality Data from the 1974 Population Census of Sierra Leone** : Census Analysis Vol.2 : Central Statistics Office. Freetown 1980

(c) C.S. OKOYE **An Analysis of Fertility Data from the 1974 Population Census of Sierra Leone.** Census Analysis Vol.3. Central Statistics Office, Freetown 1980

3.(a) William BRASS "Uses of census or survey date for the estimation of vital rates" (E/CN.14/CAS.4/V57), paper prepared for the African Seminar on Vital Statistics, Addis Ababa, 14-19 December 1964

(b) T. James TRUSSELL "A re-estimation of the multiplying factors for the Brass technique for determining childhood survivorship rates", **Population** Studies, vol 29 n 1 March 1975 pp.97-108

(c) Ansley J. COALE and Paul DEMENY **Regional Model Life Tables and Stable Populations.** Princeton, New Jersey, Princeton University Press, 1966

4.J.G.C. BLACKER "Mortality in Tropical Africa : The Demographer's Viewpoint", Paper presented for the ISI Group Meeting on Methodology of Mortality Measurement. London October 2-4 1979

5.(a) Sierra Leone Government **Infant Mortality Rate and Causes of Infant Deaths in the Western Area 1969-1971.** Medical Statistics Unit, Ministry of Health, Freetown 1973.

(b) Sierra Leone Government **Annual Report of the Maternal and Child Health Division 1977.** Ministry of Health, Freetown 1978

(c) Sierra Leone Government **Annual Statistical Digest 1980 Central Statistics Office,** Freetown 1982

6. WHO **Malaria Control Profile in Sierra Leone 1982.** WHO/ICP/MPD/002. Ministry of Health, Freetown

7. H.B.S. KANDEH **Infant and Child Mortality in Sierra Leone.** Unpublished Ph.D. Dissertation, University of Pennsylvania, 1979

8. C.S. OKOYE (see reference 2 (b))

9. World Fertility Survey **Major Findings and Implications** Alden Press, Oxford 1984

10. H.B.S. KANDEH and T.E. DOW **Levels and Determinants of Infant and Child Mortality in Sierra Leone : Patterns and Policy Implications** The Rockfeller Foundation, New York. 1987.

11.(a) J.C. CALDWELL "Education as a factor in mortality decline : An examination of Nigerian data", **Population Studies** vol 33 n 3 Nov. 1979, pp.395-414

(b) B.J. FEYISETAN "Issues in an examination of the relationship between maternal education and child mortality". Paper presented at the International Workshop on Research Issues in Child Health and Child Care held at the Institute of Statistical, Social and Economic Research, University of Ghana, 22-26 September 1986

12. see reference 10