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**STUDY ON THE INTERRELATIONSHIP BETWEEN INFANT AND CHILD
MORTALITY AND FERTILITY LEVELS AND THEIR POLICY IMPLICATIONS
IN SELECTED ECA MEMBER STATES**

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1.0 Introduction

1. Analysis of interrelationships between infant and child mortality and fertility is an important policy-oriented research on population. In order for policy-makers to formulate and implement population programmes designed to reduce high levels of fertility and mortality, particularly infant and child mortality it is imperative that adequate information about demographic processes is available. Demographic research provides important results to facilitate greater awareness about the important role played by population variables in development planning and programme implementation.

2. The size of population of any locally, society or community is determined by the demographic components of fertility, mortality and migration. In the recent past in Africa, mortality has been declining relatively faster than thirty or forty years ago. During the same time, fertility has largely remained high and constant, at levels that are closely associated with natural fertility patterns. In the last thirty or forty years, population movements have not contributed significantly to size of population within African countries.

3. The situation that prevails in Africa nowadays has come about because of various factors and demographic determinants acting either in isolation or in a complex combination to influence fertility and mortality levels as well as migration patterns, all of which determine rapidly increasing base population size of the continent of Africa. Fertility and mortality levels, particularly levels of infant and child mortality influence childbearing hence high levels of fertility in many African countries. Lack of education, short birth intervals, early childbearing and poor environment are some of the factors and determinants of high levels of fertility and infant and child mortality in Africa.

4. In almost all countries in the African region, the major sources of demographic information and data are population censuses and demographic surveys. Nearly all countries in Africa have had a population census or demographic survey conducted since 1950. Many of the countries have had several population censuses and/or demographic surveys, except very few that have had only population census or none at all, like Ethiopia, Zaire, or Chad. There have been worldwide major demographic surveys in which African countries took part. The World Fertility Surveys Programme (WFS) attracted thirteen African countries and the Demographic and Health Surveys programme (DHS) have so far been conducted in about another thirteen countries participating. Both WFS and DHS programmes brought together worthwhile demographic information and data for most countries that lacked these data in Africa.

1.1 The purpose and objective of study

5. The Demography Committee of the Sixth Session of the Conference of African Planners, Statisticians and Demographers held in 1990 at ECA recommended that a study be undertaken on interrelationships between infant and child mortality and fertility and policy implication in Africa. It was the wish of that committee that studies of this nature equip policy-makers, planners and researchers as well as demographers, with the necessary knowledge to enable the process of integration of population variables into socio-economic development planning and

implementation of programmes related policy of reduction of high levels of fertility and mortality in the population. This study attempts, therefore to analyze in brief some of the relationships between infant and child mortality and fertility in some selected countries in Africa region. The results of analysis would inform our planners for possible health policy formulation and programme implementation designed to improve infant and child survival and strategies designed to reduce persistent high levels of fertility in Africa. The study has entirely depended upon secondary data collected as part of the World Fertility Survey in the selected African countries.

6. The section that follows this introduction analyses fertility and mortality levels in some African countries. This therefore provides prerequisite information necessary for the third section which analyses interrelations between fertility and mortality. The fourth part of this report presents implication of relationships for policy formulation and programme implementation designed to reduce high levels of fertility and mortality. The paper concludes with some important recommendations targeted for policy-makers and researchers in relevant population related areas.

2.0 Population size, Fertility, Mortality and Family formation in Africa.

7. Demographic information compiled from various records of these different sources have been utilised in various types of ways to portray demographic situation in Africa. Many researchers, policy makers and demographers are now in a better position to understand the demographic consequences of many African countries than they ever have been before.

8. The world population prospects prepared for 1990 and other documents have been used in order to analyze and for us to better understand the current demographic situation in Africa as it has evolved since 1950.^{1/} The major feature of these countries is in their way of childbearing practices which are associated with natural fertility where there is absence of any control of fertility. In such societies the mechanism of childbearing and family formation determine the nature of demographic relationship especially that existing between fertility and mortality. Before analyzing this relationship it is necessary to review information about size of population, its fertility and mortality levels, and features of family formation in Africa.

2.1 Population size

9. The size of population of any locally, society or community is determined by the demographic components of fertility, mortality and migration. In the recent past in Africa, mortality has been declining relatively faster than thirty or forty years ago. During the same time, fertility has largely remained high and constant, at levels that are closely associated with

^{1/} UN, World Population Prospects 1990, New York 1991

natural fertility patterns. In the last thirty or forty years, population movements have not contributed significantly to size of population. In terms of size of population of Africa, there were about 222 millions people in Africa in 1950; this population will have increased to well over 680 million by the end of this year, 1992. Among the five sub-regions in Africa, it seems that Eastern and Western Africa constitute almost half of the total population of Africa, with both sub-regions being closely followed by Northern sub-region.

10. The sizes of population vary widely among the five sub-regions. Around 1950 Eastern sub-region had a population of about 65 million followed closely by Western at 63 million, Northern with 52 million, Middle or Central at 26 million and Southern Africa having had lowest population of 16 million. By the year 1992, according to the same source of projections, the sizes of population for different sub-regions of Eastern, Middle, Northern Southern and Western were respectively 210,220,000 for Eastern; 74,553,000 for Middle Africa; 147,867,000 for Northern Africa; 42,892,000 for Southern and 206,549,000 for West Africa. The three sub-regions of Eastern, Northern and West Africa have remained to be the most populated in the region. For the whole of Africa the population would rise to 682 million in 1992 from about 222 million in 1950.

11. However, the sub-regions are composed of different areal sizes and number of countries and territories. The Eastern sub-region has the largest number of countries followed by the Western sub-region. The Southern and Northern sub-regions have least number of countries. Furthermore, within these sub-regions there are countries that have dominant population. For example, in Eastern Africa, Ethiopia has the largest size of population, followed by Tanzania and Kenya. In Western Africa, Nigeria has largest size of population by far than any other country. In Northern Africa, Egypt is the most populated followed by Sudan and Algeria. In Southern Africa, the Republic of South Africa is the most populated. Zaire is most populated of the countries in Middle Africa.^{2/} Table 1 in the Annex presents details of population size of the continent and its sub-regions since 1950.

2.2 Fertility Levels

12. The major component of population growth in Africa has remained to be fertility. For quite a long time, fertility has remained to be high and constant in almost all the countries in the African region. Many researchers and demographers have described that fertility levels in Africa as remaining to be continuing the "regime" of natural fertility pattern because average number of children overborne to a woman exceeds a total fertility rate of 6.5 or more children. Fertility is apparently highest in Eastern and Western Africa where CBR estimates are greater than 50, and lowest among the countries in Southern Africa at around 1950. Since that time fertility has reduced only marginally to about CBR estimates of 47.9 for Eastern Africa, 46.9 for West

^{2/} UN, op.cit., New York 1991

Africa, 45.6 for Middle Africa, while Northern and Southern Africa having lowest levels of fertility at CBR estimates of 34.3 and 32.2 or TFR of 4.6 and 4.4 respectively. Thus Middle Northern and Southern Africa are in the intermediate position in terms of levels of fertility around the period 1990-95.

13. Childbearing in African region still remains at its highest levels in the world. In terms of Total Fertility Rate TFR the pattern of natural fertility appears to have remained unchanged at TFR of the range of 6.8 to 7.1 for Eastern sub-region TFR of ranging from 5.9 to 6.2 for Middle Africa, TFR of ranging from 6.8 to 4.6 for Northern Africa. For Southern Africa TFR ranged from 6.5 to 4.4 and it ranged from 6.8 to 6.7 for West Africa respectively for the period between 1950-55 and 1990-95. It is because of this very high levels of fertility that women in Africa have as many as six or more children on the average when they complete their period of childbearing. The exception were countries in Northern and Southern Africa where the total fertility rate dropped to less than five children per woman by 1990-95. Table 2 in Annex has details about levels of fertility in Africa.

2.3 Mortality Levels

14. Nearly all governments in Africa express their desire to reduce high levels of mortality and increase expectation of life for all their citizens. This desire by African governments is more forceful in their intentions about the goals of health for all by the turn of the century. The goal "Health for all and all for Health by the year 2000" is a motto for African governments. The desire to reduce mortality levels comes out of conviction that the current situation of mortality in the African region remains of great concern throughout Africa.

15. Because of greater efforts, governments have devoted to improving health, levels of mortality have consistently reduced since 1950. Nevertheless, differential mortality exists among various sub-regions in the region. Mortality levels are apparently higher in Eastern and Western Africa than in Northern and Southern Africa. Factors contributing to existence of differentials are many and complex.^{3/}

16. Mortality levels remain highest in Africa compared to anywhere in the world. During the period 1950-55 and 1990-95 the crude death rates dropped by almost half in all the sub-regions. The largest drops were observed in Northern and Southern Africa, in particular. The trend of the decline was apparently similar in Eastern, Middle and Western Africa. At the same time, mortality among infants and children remained very high. Infant mortality rates remained a three-digit figure for the whole period except during the 1980s in all sub-regions. Between 1985 and 1995 infant mortality rates were below 100 save Eastern and Western Africa. These considerably high levels of mortality, particularly that among infants and young children is the result of relatively low life expectancy at birth associated with many countries in Africa. During

^{3/} ECA, African Population Studies Series Number 8 Addis Ababa, 1985

1950-55 life expectancy at birth was disastrously low at almost less than forty years in all the sub-regions. Northern and Southern African countries were the only sub-regions where e_0 was greater than forty years. Among the sub-regions, countries in Western Africa had the lowest life expectancy at birth. Countries in Southern and Northern Africa enjoyed relatively highest life expectancy at birth being in the range of more than 60 years. These achievements though successful, levels of mortality still lagged behind the targets of the reduction of mortality. Details of estimates of mortality levels are presented in Annex, Table 3.

2.4 Demographic Transition and Family Formation in Africa.

17. Demographers and other researchers interested in population are normally keen to describe changes of major components of population. Their interest emanates from the effects of demographic transition from high fertility-high mortality to either high fertility-declining mortality, or declining fertility-low mortality and eventually to reach a stage of low fertility-low mortality. Different factors determine stages of demographic transition like the linkages existing between fertility and mortality processes in a population. These interrelationships observed between fertility and mortality reflect the way family building and formation is perceived in a particular community.

18. In Africa, in general, the communities are at their initial stage of demographic transition, ie. these communities are associated by high fertility and high mortality, and in some of them they might be at a stages of high fertility and declining mortality. Demographic situation in Africa has revealed that African countries are still in pre-transition stage of demographic changes because levels of fertility are very high with TFR of 6.5 or above which defines countries having natural fertility pattern^{4/}. However, countries that have TFR of less than 6.5 could be described as being in the early transitional stages, like those in Northern and Southern Africa.

19. The pre-transitional and those in early transitional phases are characterized by the nature of their family formation or building. The major feature of these countries is in their way of childbearing practices which are associated with natural fertility where there is absence of any control of fertility. In such societies the mechanism of childbearing are influenced by the effects of interrelationships between fertility and mortality processes. The section that follows presents analysis of interrelationships.

3.0 Interrelationships between infant and child mortality and fertility

20. Under prevailing mortality conditions and the levels of socio-economic development with the existing natural fertility " regime" the expected mortality-fertility relationship in Africa is

^{4/} UN, Family Building by Fate or Design, New York, 1987

much more complicated to analyze and interpret. In a natural fertility society such as that found among African countries, mortality is the major demographic variable subject to adjustment at the level of family. In such societies, in particular, childbearing is influenced by the conditions of infant and child mortality, the impact of birth intervals, age at first birth or entry into marriage, duration of marriage or childbearing period and the extent of breastfeeding or post-partum abstinence. In most African countries the length of birth interval is influenced by the extent of breastfeeding and the practice of sexual abstinence rather than contraceptive use to delay or control conception, as well as prevailing conditions of mortality. The strength of mortality-fertility relationships is also influenced by the extent that inadequate care of unwanted children in the society. Most often the resources of parents and the value of children, the family and kinship systems like extended family systems that exist in Africa may influence child preference or survival. The relationships between fertility and mortality eventually determine completed family size.

21. Analysis of interrelationships between infant and child mortality and fertility is an important policy-oriented research on population. The analysis most often proves that child mortality is an important determinant of fertility especially if child survivorship raises desired family size in communities which do not use contraceptives. The KPA noted that there was a relationship between mortality and fertility and called on countries to recognise that a substantial decline in infant and childhood mortality is a prerequisite for fertility decline^{5/}.

3.1 Maternal Age, Infant and child Mortality and Fertility.

22. Infant and childhood mortality tends to be relatively high for children born to younger mothers, particularly those under twenty years of age, and lower for children born to mothers aged between 20 and 34. Thereafter, the mortality rates of children of older mothers tend to rise steeply. Children born to women aged 15-19 have relatively high neonatal mortality compared to the neonatal mortality of children whose mother's age is between 20-24 and 30-34 for Sudan and Nigeria, and 20-24 and 35-39 in the case of Kenya. The pattern of neonatal mortality rates is not clear for Lesotho and Cameroon perhaps because of under-reporting of deaths of very young infants whom culturally may not be considered as human beings if they die before the naming ceremony is conducted. Nonetheless, these data also tend to have a similar pattern suggesting higher neonatal mortality rates for women aged between 20-24 and 30-34.

23. This rather peculiar observation that central child bearing age groups which are associated with peak levels of fertility should be characterized by relatively lower estimates of neonatal mortality rates should explain the biological and demographic relationships of neonatal mortality and fertility experiences that women undergo. This might suggest that limiting childbearing to these age groups should result in the reduction of neonatal mortality and completed family size.

^{5/} ECA, Kilimanjaro Programme of Action on Population, (KPA), ST/ECA/POP/1, Addis Ababa 1984

24. The pattern described for neonatal mortality is almost exactly similar for post-neonatal mortality. Post-neonatal mortality rates are relatively high for children whose mothers are in age groups 15-19 and 35 and above for Sudan and Cameroon.

25. The countries where levels of mortality are high as it is the case for these African countries, neonatal and post-neonatal mortality are caused principally by exogenous factors like parasitic infectious and gastrointestinal diseases than endogenous diseases like those connected with injury, or genetic defects. Furthermore, in high mortality countries, neonatal deaths constitute about 40 per cent of all infant deaths.^{6/}

26. The analysis further suggested that infant mortality levels are relatively high for younger mothers in the age group 15-19 and decline gradually up to about age group 30-40 for Sudan, 35-39 for Kenya, and 30-40 for Cameroon and Nigeria.

27. It is not possible for us to explain this peculiar observation from what is known that infant mortality is higher for younger and older mothers than for children of mothers in the central childbearing age group 20-24 to 30-34. Estimates in Annex Table 4 illustrate these observations.

28. Studies suggest that the infant mortality rate is not sufficient as an indicator of socio-economic development or that of the health status of the people. Mortality between age one and two years ${}_1Q_1$ and that between two and five years ${}_3Q_2$ are better indicators of environmental conditions of developing countries. Infections and their frequency of attack on children are more in malnourished children who also live in poor environmental conditions, since immunity acquired while breastfeeding is reduced after first year of life if adequate weaning foods are not provided and environmental conditions remain poor.

29. The results of analysis generally suggest that in all the countries estimates of ${}_1Q_1$ are higher for age group 15-19 than 20-24, 25-29 or 30-34. The estimates of ${}_3Q_2$ also shows almost similar pattern as of ${}_1Q_1$. The analysis so far is that maternal age is a significant determinant of infant and child mortality. For women who start childbearing when they are under 20 years or older than 35 years their children would have higher risk of death in childhood ages under 5 years. The implications as well as see later is that health policy programmes designed to reduce early child mortality ${}_1Q_1$ would result in greater reduction of child mortality between ages 1-4. Results of analysis in Table 5 of Annex illustrate these observations.

6/ WHO, Infant and early childhood mortality in relation to fertility patterns, 17, 174, Freetown 1980

--- Infant and early childhood mortality in relation to fertility patterns, pp149-153, Khartoum, 1981.

3.2 Birth Intervals, fertility, Infant and Child Mortality

30. Almost all traditional African societies frown on women who give births at short intervals. Most African communities have low contraceptive usage rates and societies rebuke women who fail to breastfeed their siblings long enough.

31. There are different ways of defining birth interval some of which may refer to the period that elapses between live births, from one conception to the next or birth interval may be taken simply as the period from live birth to conception. Birth interval has been defined as the period between one live birth to the next.

32. Generally, we observed that estimates of mortality are higher if birth interval is less than two years and if it is longer than four years or five years. Birth intervals of two or three years have been associated with relatively lower mortality rates. In fact, the data suggest that the effective birthspacing where birth intervals of three years are achieved, rates are the lowest in all the four countries. Studies conducted elsewhere come out with similar conclusion.^{7/}

33. The effect of birth intervals of less than two years is that it raises the risk of infant mortality along with its components because due to sudden cessation of lactation and lack of adequate weaning foods the child is weakened and dies due to malnutrition, parasitic and infectious diseases. In order to explain the proximate determinants of infant deaths, there have been suggestions of competition theory prevailing in a family such that more children require greater child care and feeding with older children taking more of available food and attention. Thus, the effect of short-birth intervals lead to too rapid weaning that would affect child survival chances. In fact, child mortality has been found to be higher among mothers who are pregnant at the time of weaning since such children also have low birth weights.

34. There are important links between mortality and effect of birth interval in particular and fertility in general. Like the results of our earlier analysis estimates are highest where birth intervals are less than two years. The estimates decline gradually reaching the lowest level when birth intervals are as long as three years. The estimates tend to rise again for birth intervals of four or five and more years. The effects of birth intervals on childhood mortality hence fertility are presented in Tables 6, 7 and 14 of Annex.

35. In conclusion, therefore the interrelationship that may exist between infant and child mortality and fertility on one hand and birth interval on the other is a result of complex physiological and environmental mechanisms as can be seen from our analysis. It is sufficient to conclude that too short and too long-birth intervals heighten the risk of infant and child mortality.

^{7/} B. Winikoff, "The effects of birth spacing on child and maternal mortality " in Studies in family planning, vol. 14, no.10, 1983

3.2 Birth Order, Infant and Child Mortality and Fertility.

36. Data on neonatal, post-neonatal and infant mortality classified by order of birth up to seventh or more birth order. Analysis suggests that risk of mortality for neonatal and post-neonatal as well as infant mortality are highest for first birth order, decline gradually until about birth order number 5 or 6 when the level rises again and is approximately equal to that for first birth order. However, the relationship may not be due to order of birth alone since childbearing is directly related to age of women at the time of birth. Despite this limitation on our ability to interpret the data, it is apparent that risk of mortality is relatively lower for children of birth orders 2 to 4. The estimates for birth order influence are in Table 8 of Annex.

3.3 Socio-economic determinants, Infant and Child Mortality and Fertility.

37. Since estimates of infant and child mortality rates are indicators of levels of socio-economic development, it is necessary to analyze any interrelationships between mortality and socio-economic variables. However, such studies have been hampered by non-availability of reliable data for almost all African countries, and where such data are available they are inadequate. Maternal education variable was the only socio-economic determinant with sufficient data for comparative analysis.

3.3.1 Education, Infant and Child Mortality and Fertility.

38. Evidence suggests that increasing level of maternal education associated with decline in infant and child mortality because education is associated with many factors. It is understood that women who are educated break with the traditional family methods of child care to adapt modern methods. The evidence in this break is seen in the way uneducated women in rural areas would look after their children as compared to their educated counterparts in urban areas. Educated women would provide better and more nutritious food while uneducated women would feed their children guided by traditions. In many circumstances uneducated women are fatalistic about illness, while the educated instead try to apply all medical alternatives in case of children failing ill.

39. Estimates of neonatal, post-neonatal and infant mortality vary inversely according to level of education of the mother. The results, as we expected, estimates of mortality are inversely related to level of education. The relationship between mortality and education is stronger for post-neonatal than neonatal mortality.

40. Data for Lesotho do not suggest any strong link between education and mortality in the first year of life, but estimates of post-neonatal mortality reduce gradually as the level of

education increases. Generally, suggests that the effect of maternal education is felt more if a child survives the first month of life.

41. The results suggest that child mortality declines progressively as the level of maternal education increases. This is evidently clear with data from Kenya or even Sudan, as presented in Tables 9 and 10. The relationship is, however, difficult to explain using data from Lesotho. Generally, the strength of the effect of maternal education on child mortality is almost the same for both early and late child mortality.

42. To summarize this analysis, we have observed that maternal education appears to act to reduce infant and child mortality if the level of education is relatively high. Since education is one of the variables of socio-economic development, any relationship that suggests that estimates of mortality are lower with increasing level of education should be interpreted carefully as such education effect may be an indirect or direct result of complex operations that are related to interacting mechanisms of effect of development.

4.0 Implications for Infant and Child Mortality and Fertility.

43. The analysis so far has presented results that indicate existence of very important linkages of the Mortality - Fertility relationships. In this section an attempt has been made to deduce implications of determinants of these relationships.

4.1 Birth Intervals, Infant and Child Mortality and Fertility

44. There is a complex relationship between the length of birth interval and the experience by women of childbearing age and survival of a child. It is generally believed that in societies where birth intervals are very short, childbearing is more frequent resulting in heightened levels of fertility and at the same time short intervals are detrimental to the well-being of both infants and young children as well as to their mothers.

45. Firstly, there are implications of birth intervals on fertility which are complex like the demographic-socio-economic factors that influence childbearing in a society. It is understood that short intervals reflect very high frequency of childbearing in the population. Suggesting that birth intervals of less than 12 months are associated with largest number of children overborne. It is understood that where child mortality is relatively high parents tend to bear more children to compensate or replace children who would die early in their life.

46. The second idea is the implication child death experience and length of birth interval have on population. It is believed that short birth intervals are detrimental to the health of both the mother and child. Short intervals do not give the mother enough time to recuperate from child birth and to replenish her stores of nutrients used during pregnancy. Sometimes, most births

that occur within a short interval result in underweight babies especially under conditions of malnutrition, poor maternal and child health care facilities and other health problems. Most of such children die in their early years of childhood.

4.2 Maternal Education, Infant and Childhood Mortality and Fertility

47. The aim in this part of analysis is to examine the relationship between maternal education and effect of child mortality experience on fertility. Other studies have suggested that child mortality in developing countries is associated more closely with maternal education or birth spacing than other socio-economic factors like occupation, income or type of place of residence. It is believed that formal education may facilitate use of knowledge and available health care facilities, it weakens bonds of traditional taboos about child care and it stresses the importance of hygiene and sanitation. These results are illustrated by data in Table 11 in Annex.

48. Firstly, women who have had no formal education are associated with higher childbearing practice than those who spent some years at school. It appears that the influence of education is heightened once the type of place of residence is an urban area.

49. Secondly, there is a suggestion that there exist an influence exerted by child mortality on increased number of added births in the population. These births increase whenever women had a previous child dead. This direct relationship between child mortality and fertility has a tremendous implication on population because the loss of one child more than doubles the number of added births as compared to those that had not experienced child loss, education and living in urban areas^{8/}.

50. The influence of education varies greatly between the countries. It is the experience of child loss which is significant in increasing the number of added births to almost double that for women who had not experienced child loss. In other countries such as Benin and Cote d'Ivoire education and type of place of residence play an important role on determining the number of births added. On the other hand it appears that place of residence more than education is important in Ghana and Senegal in influencing births.

The analysis presented here suggested that if child loss is controlled and status of women improved by providing education and better place of residence the number of births would be reduced.

^{8/} ECA, "Comparative study on trends in infant and childhood mortality and their implications for population growth in Africa." Addis Ababa 1987

4.3 Maternal Age, Infant and Child Mortality and Fertility

51. The size of the reproductive age groups in the total population determines the capacity and mortality. The relationships between age and demographic processes of fertility and mortality have already been established. The pattern of mortality according to age in high mortality countries is such that mortality is highest in the early and other age groups and relatively low in the intermediate age groups. Similarly, fertility is related to reproductive ages. There exist complex relationships between childbearing and maternal age as a result of child loss. The implications of early and late childbearing is that it has negative influence on childhood and maternal mortality as well as fertility being heightened over a period of time. The results of analysis are presented in Table 12.

4.4 Correlates, Infant and Child Mortality and Fertility.

52. Our analysis so far as suggested that there are direct or indirect interrelationships between infant and child mortality, socio-economic factors and fertility. These determinants included age of women at time of death of child, the length of birth spacing or live birth interval, the birth order of number of children overborne, maternal education and type of place of residence.

53. Our interpretation of results as based on the zero correlation analysis. In applying this general statistical technique our intention is to analyze relationship between index of mortality variable and three demographic determinants. The correlation coefficient measures only the degree of interrelationship existing between variables. These have been illustrated in the table of estimates of zero-order correlations presented in Table 13 of Annex.

54. On the basis of the principles of interpretation of correlation coefficients, interrelationships between mortality and its demographic determinants of maternal age, birth order and birth intervals. Neonatal mortality is strongly inversely related in length of birth interval in all countries. Furthermore, it appears that birth interval is strongly inversely related to post-neonatal, infant, early childhood and late childhood mortality in all the four countries. The relationship between mortality and birth order is not clear to interpret. Birth order is significantly inversely related to post-neonatal mortality and early childhood mortality. The apparent positive relationship between birth order and child mortality is not clear. It may be the result of sampling fluctuations or that this variable is not so much a determinant of child mortality. Maternal age has significantly strong inverse relationship with child mortality. However, the effect of these determinants of child mortality can be concealed because their strengths of interrelationships can be affected by the level of mortality in the entire population, perception of health status, deaths and general level of development.

5.0 Summary and Conclusion

55. The situation that prevails in Africa nowadays has come about because of various factors and demographic determinants acting either in isolation or in a complex combination to influence fertility and mortality levels as well as migration patterns, all of which determine rapidly increasing base population size of the continent of Africa. Fertility and mortality levels, particularly levels of infant and child mortality influence childbearing hence high levels of fertility in many African countries. Lack of education, short birth intervals, early childbearing and poor environment are some of the factors and determinants of high levels of fertility and infant and child mortality in Africa.

56. Infant and childhood mortality tends to be relatively high for children born to younger mothers, particularly those under twenty years of age, and lower for children born to mothers aged between 20 and 34. Children born to women aged 15-19 have relatively high neonatal mortality compared to the neonatal mortality of children whose mother's age is between 20-24 and 30-34. The pattern described for neonatal mortality is almost exactly similar for post-neonatal mortality. Post-neonatal mortality rates are relatively high for children whose mothers are in age groups 15-19 and 35 and above. To reduce child mortality and fertility, childbearing should be encouraged among women in central childbearing age groups.

57. Estimates of mortality are higher if birth interval is less than two years and if it is longer than four years or five years. Birth intervals of two or three years have been associated with relatively lower mortality rates. In fact, the data suggest that the effective birthspacing where birth intervals of three years are achieved, mortality rates are relatively the lowest. Thus short birth intervals should be discouraged.

58. Estimates of neonatal, post-neonatal and infant mortality vary inversely according to level of education of the mother. The results, As we expected, estimates of mortality are inversely related to level of education. The relationship between mortality and education is stronger for post-neonatal than neonatal mortality. As it has been observed that education of mother is therefore very influential on both fertility and especially infant and child mortality. Normally women with education have relatively reduced levels of fertility and their children have better chances of survival than for women without education. Provision of education to women is therefore strongly recommended in order to achieve lower levels of fertility and improved chances of child survival.

59. Under prevailing mortality conditions and the levels of socio-economic development with the existing natural fertility " regime" the expected mortality-fertility relationship in Africa is much more complicated to analyze and interpret. The results of analysis would inform our planners for possible health policy formulation and programme implementation designed to improve infant and child survival and strategies designed to reduce persistent high levels of

fertility in Africa. Provision of adequate facilities of maternal and child health and those services of family planning MCH/FP would facilitate reduction in child mortality and fertility.

ANNEX

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TABLE 1: Size of Population of the five Sub-region of Africa between 1950 and 1994.

Sub-Region	POPULATION (THOUSANDS)						
	1950	1980	1990	1991	1992	1993	1994
EASTERN (18)	64 984	144 172	196 873	203 440	210 220	217 356	224 683
MIDDLE (9)	26 316	52 183	70 054	722 262	74 553	76 928	79 388
NOTHERN (7)	51 798	107 240	140 553	144 178	147 867	151 615	155 410
SOUTHERN (5)	15 736	32 379	40 928	41 901	42 892	43 802	44 928
WESTERN (16)	63 150	141 258	193 702	200 021	206 549	213 280	220 248
TOTAL	221 984	477 232	642 111	661 802	682 132	703 090	724 657

SOURCE : UN, World Population Prospects 1990, New York 1991.

TABLE 2 : Fertility levels among Sub-regions in Africa since 1950.

SUB-REGION	1950-55	1975-80	1980-85	1985-90	1990-95
		CRUDE	BIRTH	RATES	(CBR)
EASTERN	50.5	49.3	48.2	48.5	47.9
MIDDLE	46.3	45.7	45.5	45.9	45.6
NOTHERN	48.9	41.5	40.1	37.0	34.3
SOUTHERN	43.7	35.7	34.6	33.7	32.2
WESTERN	50.6	48.8	48.6	48.3	46.9
TOTAL	49.2	46.1	45.3	44.7	43.5
		TOTAL	FERTILITY	RATES	(TFR)
EASTERN	6.8	7.1	6.9	6.9	6.8
MIDDLE	5.9	6.2	6.2	6.2	6.2
NOTHERN	6.8	6.0	5.7	5.1	4.6
SOUTHERN	6.5	5.2	5.0	4.7	4.4
WESTERN	6.8	6.9	6.9	6.9	6.7
TOTAL	6.7	6.5	6.4	6.2	6.0

SOURCE : UN, World Population Prospects 1990, New York 1991.

TABLE 3 : Mortality levels among Sub-regions in Africa since 1950.

SUB-REGION	1950-55	1975-80	1980-85	1985-90	1990-95
		CRUDE	DEATH	RATES	(CDR)
EASTERN	28.2	18.8	18.3	16.4	14.6
MIDDLE	28.2	19.1	17.6	15.9	14.5
NOTHERN	24.7	14.4	12.6	10.8	9.4
SOUTHERN	21.0	12.6	11.4	10.2	9.0
WESTERN	28.4	19.5	17.9	16.5	15.0
AFRICA	26.9	17.6	16.4	14.7	13.2
		INFANT	MORTALITY	RATES	(IMR)
EASTERN	179	131	126	114	103
MIDDLE	195	118	108	98	89
NOTHERN	189	121	105	79	69
SOUTHERN	153	98	87	77	67
WESTERN	203	132	121	111	102
AFRICA	188	126	116	103	94
		EXPECTATION	OF	LIFE	AT BIRTH (e.)
EASTERN	37.0	47.1	47.9	50.6	52.9
MIDDLE	35.8	45.6	47.6	49.9	52.0
NOTHERN	41.9	53.9	56.6	59.1	61.0
SOUTHERN	43.9	55.2	57.3	59.7	62.2
WESTERN	35.1	44.7	46.7	48.8	50.8
AFRICA	37.7	47.9	49.6	52.0	54.1

SOURCE : UN, World Population Prospects 1990, New York 1991.

TABLE 4 : Estimates of neonatal (NND), Postneonatal (PNND) and Infant (IMR) Mortality rates by maternal age for Sudan, Kenya, Lesotho, Cameroon and Nigeria

MATERNAL AGE	<u>SUDAN</u>			<u>KENYA</u>			<u>LESOTHO</u>			<u>CAMEROON</u>			<u>NIGERIA</u>		
	NND	PNND	IMR	NND	PNND	IMR	NND	PNND	IMR	NND	PNND	IMR	NND	PNND	IMR
15-19	55.6	39.5	101.4	46.5	66.1	111.3	57.2	71.7	126.6	54.4	64.5	115.0	46.5	50.1	93.3
20-24	35.6	20.4	64.9	38.8	44.0	80.9	62.6	65.8	124.7	49.4	59.1	105.1	33.7	42.1	75.7
25-29	41.2	12.9	71.3	36.7	50.7	86.5	54.0	59.1	110.3	42.1	56.8	97.2	36.4	41.1	76.1
30-34	40.0	21.6	68.7	34.0	50.0	83.8	65.8	75.1	136.4	47.8	53.4	100.6	39.1	49.3	86.9
35-39	64.6	33.3	89.4	36.2	45.9	79.7	65.2	58.0	120.5	52.2	56.6	105.8	64.2	49.5	111.6
40-44	37.7	60.2	94.2	50.8	67.7	113.8	59.3	55.0	115.9	52.5	86.9	136.4	49.4	55.4	95.5
TOTAL	43.8	35.7	78.3	39.2	51.8	89.8	60.2	65.7	122.8	49.1	59.9	106.5	41.0	45.8	85.1

TABLE 5 : Estimates of early childhood $1q_1$ and late childhood $3q_2$ mortality
for Sudan, Kenya, Lesotho, Cameroon and Nigeria

	SUDAN		KENYA		LESOTHO		CAMEROON		NIGERIA	
MATERNAL AGE	$1q_1$	$3q_2$	$1q_1$	$3q_2$	$1q_1$	$3q_2$	$1q_1$	$3q_2$	$1q_1$	$3q_2$
15-19	38	39	35	37	34	34	45	52	38	43
20-24	27	34	26	30	34	39	39	54	27	41
25-29	28	35	28	29	23	24	37	63	36	36
30-34	24	41	28	44	29	24	29	65	31	34
35-39	35	50	27	52	19	28	33	61	36	46
40-44	40	49	22	27	24	35	34	42	32	34
TOTAL	30	39	28	37	30	32	38	58	33	40

TABLE 6 : Estimates of neonatal, postneonatal and infant mortality rates, birth intervals for Sudan, Kenya, Lesotho and Nigeria classified by previous birth interval

PREVIOUS BIRTH INTERVALS	SUDAN			KENYA			LESOTHO			NIGERIA		
	NND	PNND	INFD	NND	PNND	INFD	NND	PNND	INFD	NND	PNND	INFD
2 YEARS	56	48	101	48	69	102	115	103	208	53	67	116
2 "	35	31	65	29	43	62	52	61	111	38	35	72
3 "	27	25	51	27	33	55	46	62	104	29	30	57
4 "	26	6 ^a	31 ^a	29	41	64	50	41	83	31	21	52
5+ "	30	3 ^a	31 ^a	25	31	53	36	53	90	27	13	39

^a Very small sample size.

TABLE 7 : Estimates on early child 1^q₁ and late child 3^q₂ mortality for Sudan, Kenya and Nigeria classified by previous birth interval

PREVIOUS BIRTH INTERVAL	SUDAN		KENYA		NIGERIA
	1 ^q ₁	3 ^q ₂	1 ^q ₁	3 ^q ₂	4 ^q ₁
2 YEARS	39	47	36	41	97
2 "	31	41	27	38	72
3 "	11	20	17	28	62
4 "	20	32	13 ^a	15 ^a	49
5+ "	36	38	12 ^a	28	38

^a Represents a Small Sample Size.

TABLE 8 : Estimates of neonatal, postneonatal and infant mortality classified by birth order for Sudan, Kenya, Lesotho, Cameroon and Nigeria

BIRTH ORDER	SUDAN			KENYA			LESOTHO			CAMEROON			NIGERIA		
	NND	PNND	INFD	NND	PNND	INFD	NND	PNND	INFD	NND	PNND	INFD	NND	PNND	INFD
1	51	40	88	43	53	96	56	60	114	57	61	114	37	29	66
2	37	47	82	31	50	81	51	54	101	46	52	94	20	22	42
3	40	34	73				60	69	126	44	59	100	25	21	46
4	37	22	59	36	49	85	61	88	143	41	55	94	26	28	54
5	51	39	88				51	66	117	45	62	105	35	33	68
6	50	27	73				79	68	145	52	64	114	32	36	68
7+	46	30	78	47	56	103	93	83	175	42	62	105	48	42	90

TABLE 9 : Estimates of neonatal, postneonatal and infant mortality classified by maternal education for Sudan, Kenya, Lesotho and Nigeria

EDUCATION LEVEL	SUDAN			KENYA			LESOTHO			NIGERIA		
	NND	PNND	INFD	NND	PNND	INFD	NND	PNND	INFD	NND	PNND	INFD
NO EDUCATION	43	34	76	42	61	100	61	63	121	44	48	90
SOME EDUCATION	35	39	73	42	44	84	65	98	158	33	58	88
PRIMARY (LOWER)	-	-	-	37	47	83	66	55	119	49	39	87
PRIMARY (UPPER)	-	-	-	35	34	69	53	70	120	30	30	57
SECONDARY & ABOVE	-	-	-	27	26	54	65	48	108	24	11	35

TABLE 10 : Estimates of early 1^q₁ and late 3^q₂ child mortality classified by maternal education for Sudan, Kenya, Lesotho and Nigeria

EDUCATION LEVEL	SUDAN		KENYA		LESOTHO		NIGERIA	
	1 ^q ₁	3 ^q ₂	1 ^q ₁	3 ^q ₂	1 ^q ₁	3 ^q ₂	1 ^q ₁	3 ^q ₂
NO EDUCATION	31	44	35	42	25	25	36	43
SOME EDUCATION	26	15	29	29	30	49	32	40
PRIMARY (lower)	-	-	19	25	31	27	29	42
PRIMARY (upper)	-	-	22	28	28	32	23	20
SECONDARY & ABOVE	-	-	6	13	24	13	19	13

TABLE II

	BENIN										COTE D IVOIRE										GHANA										MAURITANIA										SENEGAL									
EDUCATION	CHILD DEATH										CHILD DEATH										CHILD DEATH										CHILD DEATH																			
	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9										
NO																																																		
EDUCATION	2.1	3.2	3.6	4.0	4.5	2.0	3.4	4.1	4.4	4.7	2.9	4.1	4.3	4.5	4.7	2.5	3.6	4.1	4.7	5.5	1.8	3.4	3.7	4.0	4.8																									
1-3 years	1.8	2.3	4.5	-	4.7	1.5	2.8	3.4	1.0	6.0	2.1	3.2	4.3	4.0	-	2.8	3.5	4.3	4.3	5.3	1.8	3.7	2.0	-	4.0																									
4-6 years	1.6	3.4	3.3	3.3	-	1.4	2.1	2.6	3.0	4.0	2.2	3.4	4.2	5.8	7.0	2.2	3.4	4.8	4.0	8.0	1.3	3.1	3.3	3.5	-																									
7+ years	0.8	3.9	2.0	-	5.0	1.2	2.3	2.9	2.0	-	1.2	2.2	3.3	4.3	3.0	1.5	2.0	-	-	-	0.8	1.7	-	-	-																									
URBAN NO																																																		
EDUCATION	2.3	4.5	5.8	7.4	8.4	2.0	4.2	5.8	7.8	8.5	3.0	5.4	6.3	7.6	8.5	2.8	4.4	6.1	7.8	9.5	2.4	5.0	6.8	7.6	8.3																									
1-3 years	1.8	3.3	6.3	-	10.3	1.6	4.2	5.6	-	-	1.8	4.6	7.3	-	-	2.8	4.4	6.3	7.5	9.7	2.3	5.3	3.3	-	8.0																									
4-6 years	1.7	4.8	5.4	4.5	-	1.4	3.0	4.7	6.3	-	1.9	4.4	7.2	-	-	2.3	4.4	4.7	7.0	12.0	1.3	4.0	5.3	7.0	-																									
7+ years	0.8	5.2	4.0	-	9.0	1.1	3.5	5.0	5.0	-	1.3	3.3	5.1	6.5	8.0	1.5	3.0	8.0	-	-	0.8	3.0	-	8.0	-																									
RURAL NO																																																		
EDUCATION	2.1	4.1	5.6	6.9	8.6	2.1	4.8	6.2	7.3	8.7	2.8	5.0	6.3	7.5	8.8	2.5	4.6	2.1	7.6	9.5	1.5	4.2	5.4	6.8	8.7																									
1-3 years	1.8	3.3	5.0	-	7.0	1.5	3.2	5.4	4.5	10.0	2.2	3.9	5.8	7.0	-	2.4	4.6	6.3	7.2	9.0	1.0	3.8	5.0	-	-																									
4-6 years	1.3	3.8	5.0	7.3	-	1.5	3.1	4.5	5.5	8.0	2.3	4.3	5.8	8.8	10.0	1.8	-	-	-	-	1.3	4.3	-	5.0	-																									
7+	0.4	4.0	-	-	-	1.4	2.3	4.0	-	-	1.2	3.2	5.4	7.5	8.3	-	-	-	-	-	1.0	2.0	-	-	-																									

Number of Birth Added Classified by Number of Dead Children and Age of Mother

[illegible]

TABLE 13 : Estimates of zero-order correlation coefficients, r , between mortality index and demographic determinants for Sudan, Kenya, Lesotho and Nigeria

MORTALITY TYPE	SUDAN			KENYA			LESOTHO			NIGERIA		
	MATERNAL AGE	BIRTH ORDER	BIRTH INTERVAL	MATERNAL AGE	BIRTH ORDER	BIRTH INTERVAL	MATERNAL AGE	BIRTH ORDER	BIRTH INTERVAL	MATERNAL AGE	BIRTH ORDER	BIRTH INTERVAL
NEONATAL	-.4507	.1351	-.7005	.5458	.1949	-.9512	.1933	.8069	-.6522	.7385	.6979	-.8074
POSTNEONATAL	-.4257	-.2144	-.9659	.0082	.1902	-.8810	-.6316	.5957	-.6819	.7085	.7440	-.8331
INFANT	-.4399	.0197	-.0197	.2814	.1706	-.9002	-.2944	.8572	-.6792	-.6814	N/A	-.8239
EARLY CHILDHOOD	-.3623	-.1099	-.8291	.1094	-.4480	-.9002	-.6526	-.8198	N/A	N/A	N/A	N/A
LATE CHILDHOOD	-.2191	.2267	-.7083	-.4277	.9009	-.9388	-.3957	-.6366	N/A	N/A	N/A	N/A

N/A = NOT AVAILABLE

TABLE 14 Average Number of Live Birth and Births Added by Length of Birth Interval and Type of Residence

BIRTH INTERVAL (months)	BENIN		COTE D'IVOIRE		GHANA		MAURITANIA		SENEGAL	
	BIRTHS	ADDED	BIRTHS	ADDED	BIRTHS	ADDED	BIRTHS	ADDED	BIRTHS	ADDED
URBAN										
LESS 12	5.0	3.8	6.0	4.2	4.8	3.1	6.2	4.8	5.7	3.1
12-23	5.0	3.7	4.9	3.7	5.1	4.2	5.3	4.2	5.2	3.7
24-35	4.7	3.7	4.9	3.8	4.7	4.1	5.1	4.1	5.4	4.1
36-47	4.7	3.6	4.9	3.8	4.5	3.9	4.9	4.1	5.3	4.0
48+	4.7	3.5	4.8	3.6	4.4	3.8	4.7	3.8	5.2	3.7
RURAL										
LESS 12	5.0	4.1	4.3	2.7	3.7	1.8	5.8	4.5	5.0	3.5
12-23	4.6	3.6	4.4	3.5	4.7	4.0	4.9	4.1	4.8	4.0
24-35	4.5	3.5	4.4	3.6	4.5	4.0	5.0	4.1	5.3	4.4
36-47	4.6	3.7	4.5	3.7	4.4	3.9	4.8	4.1	5.5	4.6
48+	4.6	3.8	4.3	3.4	4.1	3.6	4.4	3.7	5.0	4.0
RURAL										
LESS 12	5.0	3.6	7.2	5.2	5.3	3.7	6.4	4.9	6.1	2.8
12-23	5.2	3.8	5.2	3.8	5.3	4.3	5.5	4.2	5.4	3.5
24-35	4.8	3.6	5.2	4.0	4.8	4.1	5.1	4.1	5.5	3.9
36-47	4.8	3.6	5.2	3.9	4.6	3.9	5.0	4.1	5.2	3.6
48+	4.6	3.4	5.1	3.8	4.6	3.9	4.9	3.9	5.3	3.6