

COMMITTEE FOR INTERNATIONAL COOPERATION IN NATIONAL RESEARCH IN DEMOGRAPHY

(C. I. C. R. E. D.)

Inter-center Collaborative Research Meeting on Infant and
Childhood Mortality in the Third World. Chapel Hill, North
Carolina, U.S.A. 3rd - 6th September 1979

INFANT AND CHILD MORTALITY IN THE THIRD WORLD: BACKGROUND INFORMATION
AND PROPOSALS FOR COOPERATIVE STUDIES AMONG DEMOGRAPHIC CENTERS

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1. The Committee for International Cooperation in National Research in Demography (CICRED) approved in 1977 several inter-center cooperative research projects aiming at "strengthening the collaboration amongst population centers having similar research interest. Such collaboration could improve research productivity by eliminating needless duplication of effort, by speeding up the exchange of experience, by sharing supportive facilities where possible, by providing the environment for a more stimulative and critical intellectual interchange".
2. "Infant and Child Mortality in the Third World" was selected as one of the subjects for cooperative research. This document, prepared by the Coordinator of the project, summarizes background information and suggests areas of study, for the discussion at a meeting of the participant Centers at Chapel Hill, North Carolina, U.S.A., on September 3-6, 1979.
3. The organization of the document is as follows:
 - I. Sources of data and methods of estimation.
 - II. Main characteristics and problems for research.
 - III. The explanatory studies.
 - IV. Consequences of the infant mortality decline in fertility.
 - V. Some proposals for the inter-center cooperative program.

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1. SOURCES OF DATA AND METHODS OF ESTIMATION

Sources of data

4. The traditional sources of data for the study of infant and child mortality are civil registration of births and deaths, which are in extreme defficient or even non-existant in the Third World. When available, its completness is usually lower in rural populations, so the analysis of geogra- phic constrasts is unreliable. In general, the countries or regions where these registers are more complete, are also more advanced in the transition of mortality and in socio-economic development, and they do not represent the conditions prevailing in this region. The availability of these date are generally better in Latin America and certain Asian countries.
5. Vital statistics have the advantage of their national coverage and con- tinuity, of providing information on causes of death, and permitting the study of mortality by age, geographic regions and trends. It is a source of data that should not be discarded, but used to the maximum of its possibilities. Even an incomplete register can inform on trends, if the omission has been more or less constant, and approximate rates for certain cities can be estimated. In some countries where civil registration is acceptable, its use has made important contributions to the knowledge of infant and child mortality, using socio-economic variables and the causes of death (Taucher, 1978).
6. Given these conditions, surveys have had a great development as an alter- native source of data, which in many countries is almost the only one existing. They comprise multiple purpose demographic survey, mortality surveys and fertility surveys including information on mortality. The retrospective studies (surveys or censuses) investigate deaths occurred in a reference period and/or the total number of children ever had and the surviving children; in fertility surveys, usually a full maternal history is available. In multiple round surveys, the occurrence of mortality for a period of time is observed in a population sample or in a cohort of births.

7. Surveys have the advantage that variables under study can be selected (in contrast with vital statistics and censuses), referring to the child, the mother, the family and the housing conditions. However, the analysis is limited by the size of the sample; the information of certain surveys is many times restricted to a given population within a country.
8. Experience shows that surveys are subject to errors which may be important, mainly due to omission in the declaration of deaths or errors in the time location of the death when a retrospective period of reference is used. These errors are less frequent in multiple-round surveys, which, on the other hand, are more complex and costly. It has been shown that the omission of deaths can be differential by sex of the child and by region of residence, factors which distort mortality differentials. In some cultures, especially in Africa and in Asia, beliefs on death may generate a purposive concealment of child deaths (Madigan, 1975), producing serious underestimation of mortality. The use of the randomized response technique has been found to increase the reliability of mortality declaration in certain trials (Krotki, 1977). Some procedures have been described in order to correct retrospective information on deaths occurred in the last 12 months (Traore, quoted by Tabutin, 1979).
9. Dual-record system apparently provides a more complete and accurate information on births and deaths, but its application until now has been restricted to limited areas of certain countries.
10. Sources of information are particularly poor in reference to an important variable, the causes of death. To the limitations of mortality registration, it has to be added the fact that usually only a part of registered deaths have a medical certification. Without dismissing the possibility of making the most possible use of vital statistics, in some countries it has been attempted to obtain information from the family by means of a trained non-medical interviewer (Cantrelle, 1979). This procedure has allowed to get precise diagnosis (accidents, childbirths), probable ones (measles, smallpox) or indicative symptoms (diarrhoea, cough, fever) in a relatively important proportion of child deaths. The hospital records on deaths and diseases are also useful; although usually not representative of the whole population, they have the advantage of a better quality of the diagnosis.

Methods of estimation

11. The main developments in this field are the indirect methods of estimation of child mortality, principally elaborated by Brass (with variants by Sullivan and Trussell). The method derives estimation of ${}_xq_0$ from the proportion of dead children of women classified by quinquennial groups of age. It has the advantage of its simplicity, of using available information on population censuses and surveys, and of permitting the study of mortality differentials by various characteristics of the mother and the head of the family. The method has obvious limitations. It does not provide estimations by year of age, a variable that is important to analyze in child mortality. The assumptions of constant mortality and fertility are rarely fulfilled; Brass has elaborated a correction for the case of declining mortality. It has been pointed out that the mortality models used in the method do not have the same age-structure that has been observed in some countries. Estimations are affected by the defects in the declaration of children ever born and surviving children. In so far as these factors are not constant in the various groups analyzed, the study of differential mortality may be distorted. Some evaluation of Brass estimates has been published with other sources of information, sometimes with similar results and sometimes with important disparities. According to the CELADE experience, in the study of 12 Latinamerican countries, the method showed a tendency to underestimate mortality, but generally differential mortality estimations were highly consistent (Behm, 1976-1978).

12. Recently Brass has critically review several methodological problems in the application of his method to the study of mortality differentials. Brass concludes that "those reserves are of marginal consequence compaired with the basic simplicity, robustness and flexibility of the technique, and that serious biases in differentials are unlikely because similar patterns in the sub-groups can be expected to produce similar errors in estimate of levels (Brass, 1979).

13. Preston y Palloni have elaborated a new method of estimation based on the age structure of surviving children. The method has the advantage of not making assumptions on mortality and fertility trends, and allowing a free

grouping of women by age, which is important when working with small samples. It requires, nevertheless, information on the age of surviving children. Haines and Avery have applied this method in association to the own-children method in Central America (Haines y Avery, 1978). Feeney has developed a method to estimate the trends of the infant mortality rate on the basis of the proportion of death children by quinquennial age-groups of women.

14. The previous summary shows that improving methods to get basic data and methods of estimation is an important subject for research in the study of infant and child mortality in the Third World. It is obvious that, at present, no source of data and no method of estimation is completely satisfactory. For a long time ahead, the knowledge of that mortality will continue to depend on the best possible use of all sources of data and methods of estimation. In this sense, the study of this methodological problem is important.

15. In this subject, some of the questions that might be considered in the inter-center cooperative program are the following:

- a) To the benefit of future and in-process research, is it possible to interchange the experience of the Centers (or to develop new research) on the frequency, magnitude distribution and sources of survey errors, as well on the techniques to reduce or to correct them? Can a greater experience be obtained in the use of the randomized response technique or other procedures to control errors?
- b) In spite of their limitations, indirect methods will continue to have wide use. There does not seem to be a consensus on its limitations. Is it possible to program a systematic evaluation of indirect methods in order to know its possibilities and restrictions in different populations, particularly in the study of differential mortality?
- c) Could be the new methods available be subjected to evaluation and eventually new estimation techniques be developed?

II. MAIN FEATURES OF INFANT AND CHILD MORTALITY IN THE THIRD WORLD

16. The breach of the mortality between the Third World and the advanced countries is enormous under 5 years of age. Towards 1970 it is estimated that infant mortality rate by regions ranged from 64 to 200 per 1000 births in the former, and between 12 and 31 per 1000 in the latter (Vallin, 1976). Although at lower levels, the difference is proportionally higher in early child mortality (1-4 years of age): estimates vary between 4 and 40 per 1000 in the first group and between 0,8 and 1,0 per 1000 in the second one (Dyson, 1977).
17. This contrast is even more significant if the size of populations exposed are considered. It is estimated that 72 per cent of world population lived in developing regions and that 84 per cent of world births occurred there by 1975.
18. The decline of this mortality will have a great impact in the improvement of life expectancy at birth. In some Asian countries it has been observed that the decline of mortality under five years of age has contributed with as much as 30-50 percent of that improvement.
19. Although a high mortality usually prevails, the situation is very heterogeneous among regions of the Third World. In general, mortality is lower in Latin America and higher in Africa, with an intermediate situation of Asian countries. There is also a great range of variation amongst countries. For example, in a group of 22 selected Asian countries, in the early 70's, only two have a rate lower than 40 per 1000, where less than 0,5 per cent of total births takes place. On the other hand, there are 8 countries having a rate higher than 120 per 1000, where 78 per cent of total births and 86 per cent of infant births are estimated to occur (NU/WHO, 1979).
20. Knowledge about mortality trends is very imperfect. The countries in which it has been possible to detect a significant decline are usually

those with better vital statistics and also more developed, and so are not representative of the Third World. In general, it is estimated that infant and child mortality have decline in several countries, but that gains are not significant enough to substancially modify the mortality situation in a reasonable period of time (see Montoya, 1975, for example). There is evidence that the rate of decline of general mortality has tended to diminish in the 60's in the underdeveloped regions (Gwatkin, 1978).

21. The wide range of infant and child mortality in the Third World makes difficult a global study. On the other hand, the heterogeneity of existing situations provides an exceptional opportunity to the inter-center cooperative program to study the mortality transition that is occurring in the Third World by comparing populations that are in different stages of the transition process.

Sex differentials of mortality

22. In some countries, particularly in Asia, a female surmortality has been observed in the age 1-4 years, while infant mortality shows the usual male excess (1).

23. As commented further on, the study of this differential provides information on the cultural determinants of early child mortality.

Age-structure of mortality

24. In general, the risk of dying is higher immediately after birth and declines progressively in childhood. When infant mortality is high, the greatest excess regarding developed countries are found in post-neonatal mortality, largely produced by exogenous causes (2). Study of mortality in this age should have priority because its decline will greatly contribute to the reduction of the excesive mortality under 5 years of age.

25. In the group 1-4 years of age, the second year has the highest mortality, although generally lower than infant mortality. Nevertheless, in some

countries, mainly in Tropical Africa, a different distribution has been described, where the high mortality of the second semester of the first year is extended to the second year and even to the third one.

26. The study of the frequency of this distribution in the Third World is important, because it affects indirect estimations based in model life tables, especially when infant mortality estimates are so derived. It is also important to find out the causes of this particular age distribution of early child mortality. Indirect methods are not suitable for this purpose since they do not allow to estimate mortality by year of age.

Geographical differences of mortality

27. While in developed countries the urban/rural contrasts tends to disappear, in the Third World rural mortality is usually higher than urban. Differentials are variable but of an important magnitude. Mortality has been found inversely proportional to the degree of urbanization, with lower rates in the capital city.

28. Rural high mortality is particularly significant because the majority of the developing countries are mostly rural.

29. Only by exception the place of residence explains by itself these mortality contrasts, such as is the case of malaria endemic areas. They are mainly related to the different social, economic and cultural context existing in different regions, as commented further on. Nevertheless, the geographic distribution of mortality is an important variable of study providing information for the explanation of the mortality situation in a given country. On the other hand, it helps to identify populations exposed to higher risks (target population), useful for formulating programs to control mortality. Furthermore, the place of residence is an ever existing basic data.

30. In the study of geographic differentials must be taken into consideration the error originated in a differential rate of omission among different populations.

Mortality differentials by mother's education

31. In several studies it has been found that infant and child mortality is closely and inversely correlate with the education attainment of the mother. It is so an important determinant of the high mortality in the Third World, where population with none or very low level of education are the majority.
32. Differentials by education of infant and child mortality are greater in developing countries than in developed countries. In countries where this mortality is high, the risk in the illiterate population reaches unusually high levels, observed in the advanced world almost a century ago.
33. It has been observed that the higher rural mortality is explained in great measure by the lower levels of education existing in the rural population. The mortality of children of illiterate women shows a relatively small urban/rural differential, both being extremely high.
34. Geographic and educational variables are available in many of the researches on infant and child mortality carried on by the Centers. This provides a good opportunity to study the epidemiology of this mortality in the different socio-economic and cultural contexts existing in the Third World.

Other mortality differentials

35. In some investigations it has been possible to analyze mortality contrasts in the first years of life by other social, economic and cultural variables: ethnic groups, religious groups, occupational characteristic of the head of the family, education of the father, etc. It is usually observed that groups that have a higher socio-economic level in a society, show a lower mortality.
36. Even in advanced countries with a low infant mortality, socio-economic contrasts of early mortality do exist. What is characteristic of the mortality situation of the Third World -and makes it even worse- is that socio-economic mortality differentials are bigger and that populations in the lower strata are a majority (3).

37. The effect of socio-economic and cultural variables on mortality has important interactions, which makes difficult its analysis. These differentials are important for the explanatory study of the mortality. As indicated further on, it is important to integrate these and other variables in a global frame of analysis, if one wants to explain - and not merely to describe - these mortality differentials.

38. A variable which is only considered by exception and that has much analytical significance, is the social class (4). In fertility and mortality studies carried on in CELADE (Latinamerican Demographic Center) it has been found that social class is associated to important differentials (5).

Causes of death

39. The cause of death is an important intermediate variable in the chain of events leading to the death of the child. Unfortunately, as already mentioned, reliable information on causes of death is rarely available in the Third World. As usual, the countries with acceptable information are in a more advanced stage of mortality transition and development.

40. Nevertheless, there is evidence that excess infant and child mortality is mostly determined by three group of causes: infective and parasitic diseases (mainly diarrhoeal diseases), malnutrition and acute respiratory infections. This explains that post-neonatal mortality is usually the highest. In the neonatal mortality prevails premature and causes of death linked with deficient or absence of health care during pregnancy, childbirth and to the newborn. A high, early and prolonged fertility exposes the newborn to conditions of higher risk: high order of birth, shorter intergenetic spacing, fertility in extreme ages of the women, etc. Some studies have analyzed the relationship of these and other factors with causes of death (Puffer, 1973; Taucher, 1978).

41. For several of the main causes of death in infancy and childhood, we have today efficient techniques of prevention and treatment. This links

the problem of mortality with the existant health services in the population, problem which is considered further on.

42. In this respect, the study of mortality should be extended to the study of diseases generating the mortality. Nevertheless, morbidity studies are much more complex and the available information in the Third World is even more incomplete than on deaths.

43. In the absence of information on causes of death, an estimation of mortality by endogenous and exogenous causes can be made using the Bourgeois-Pichat method. Some reserves on its use have been pointed out in African countries, where the age distribution in the first year of life is unusual (Tabutin, 1979).

44. The seasonal distribution of infant deaths has been described as an additional information on causes, since it is usually related with seasonal variations in the incidence of certain diseases.

45. The description of levels, trends and differentials of mortality is a useful step in the analysis of the problem. But the next important step is to explain them in the context of a global interpretation of the mortality (6,7). This point is discussed in the following chapter.

III. THE EXPLANATORY ANALYSIS OF INFANT AND CHILD MORTALITY
IN THE THIRD WORLD

46. The analysis of mortality differentials may have two purposes: (a) to identify populations exposed to different levels of risk, and (b) to explain the situation of mortality as a function of factors considered as determinants.
47. The practical importance of mortality differentials depend upon the size of the populations exposed to different risk of death. The identification and quantification of these populations is basic to define policies and programs aiming to reduce mortality (target populations). Concerning infant and child mortality, this means to estimate the number of births in the various groups identified as having significant differential risks. This is an objective not usually taken into consideration in mortality studies.
48. To explain the level, trends and other characteristics of the mortality in a population is an even more important objective. The advantages of having a general theory to explain the transition of mortality are evident. From the demographic point of view, better criteria could be obtained for predicting future trends. As concern to policies to control mortality, a consistent general explanation would provide information on the crucial factors to be controlled in order to bring a substantial reduction of mortality.
49. There is an extensive evidence that infant and child mortality is associated with the degree of socio-economic development (8). But the nature of this relationship is not well known nor the way in which each of the components of development affects the mortality.
50. Although at individual level, disease and death are essentially biological phenomena, at the collective level these biological factors are strongly determined by the social and economic context, which

generates ways and levels of living conditions influencing, in their turn, the child survival. This context also works through the dynamic and internal structure of the family, as shown by studies at this level of analysis. The disease and the death of a child, as a social fact, should therefore be analyzed in the context of a social theory, theory that has not been yet elaborated. It does not seem to be an easy task. The long road covered in the study of fertility, since the initial KAP studies until the recent formulation of general theories of fertility, is a significant example of the work ahead in the analysis of mortality.

51. For the sake of the present discussion, the determinant factors of infant and child mortality are grouped in three categories: (a) the historic stage of socio-economic development, (b) the social policies, and (c) the cultural determinants.

The historic stage of socio-economic development

52. Socio-economic development is usually considered a process of modernization, industrialization or westernization of a society. In the agrarian sector, is the transition from a primitive, subsistence, non-monetary, low-productive, kin-based agricultural production, to a modern, technified, high-productive, managerial production. In the non-agrarian sector it means the transformation of the artisan production and a restrictive market distribution to a mass-production, highly industrialized and productive, with giant national and international markets. Both activities are based on a salaried labour force. This process is expressed in substantial raises in income, production and consumption; in important changes in consumption and social aspiration patterns and improvement in the usual social indicators (education, health, social security, housing, etc.). The process is not linear and has many intermediate stages.

53. Experience has showed that this transition is associated to significant declines of both infant and early childhood mortality. These rates have reached its lowest historical levels in advanced industrial countries and show a steady decline at present (9).

54. Other interpretation of this process is to consider it as a transition of modes of production, from a pre-capitalist economies to an advanced capitalist system. This is the frame that Caldwell has used in his most recent formulation of a general theory on fertility (Caldwell, 1978).

55. Whatever general frame of reference is adopted, it is evident that the interpretation of the trends and differentials of mortality in the Third World should be considered in the context of this historic process of change. In footnote 10 a United Nations report in the social conditions existing in Latinamerican agriculture population is summarized, as an example of the realm where high rural infant and child mortality is occurring.

The role of social policies

56. Usually, national governments implement policies aiming to reduce inequality in the distribution of social and economic benefits among the different social groups, policies needed as well to reproduce the required labour force for the production process. Such are policies on social security, education, health, housing, agrarian reforms, etc. This is a new factor to be considered in the analysis of mortality. It has been shown that mortality is lower, at the same level of national income, if its distribution is more equalitarian (Battacharyya, 1975). In some countries, the observed decline of mortality has been more marked than expected according to the economic indicators, a fact that has been explained by the implementation of more efficient and equalitarian social policies (Preston, 1976).

57. In the set of these social policies, the especific activities developed by the health sector aiming to reduce morbidity and mortality, are of especial relevance, along with programs to improve environmental sanitary conditions. Health interventions are developed mainly in the public sector, thus making it feasible, at least in theory, to organize them according to a national policy.

58. For a time, controversy on the causes of the decline of mortality in the developing countries was centered upon the discussion of whether it was due to the improvement of living conditions derived from socio-economic development, or to the extension of health programs making use of modern technology. There is now consensus in considering that these are not alternative options, that health policies are a part of social policies, and that the individual and collective health depend on the progress in all and each of the social and economic sectors in a society.

59. The problem consist in determining the scope of especific health interventions in the different historic socio-economic contexts which exist in the Third World. To find out, in those conditions, what degree of reduction in mortality, in what period of time, and to what cost may be achieved with different forms of organization of the health programs. There exist at present techniques of preventions and treatment of diseases which are important causes of death. Some of them are highly effective, of low cost and they can be applied at a mass scale. None of them were available in the past in advanced countries, when they experienced the high mortality prevailing at present in the Third World; this opens meaningful perspectives to deal with the problem in developing countries.

60. It has been hypothesized that in conditions of high mortality, the effect of medical interventions require a certain economic "take off". When it so happens, mortality would decrease with a certain intensity, mainly as effect of medical activities. When mortality reaches a certain level, the decline would tend to decrease again, and further improvement of socio-economic conditions would be necessary. In a certain way, the structure of causes of death supports that interpretation. It is likely that certain causes of death in a situation of high mortality be reducible with health techniques of high efficiency and low cost: infectious diseases preventable by vaccination (measles, for example), or parasitic diseases controllable by environmental interventions (malaria) or diseases where case fatality can be reduced by early treatment (diarrheal diseases). Once mortality

due these causes has declined to a certain level, further progress depends on more complex action to improve environmental conditions, and health programs requiring a more complex implementation (for example, neonatal mortality needs to improve the care of pregnant women, childbirth and newborn).

61. It is important to emphasize that this is not exclusively a problem of knowledge, but it mainly concerns with the capacity to organize its use in such a way that its benefits reach all the population, especially the groups exposed to greater risk. In this sense, the health sector is subjected to the same constraints of the social system which it belongs to. The fact is that in many countries of the Third World the coverage on health services is quite incomplete; it covers mainly the urban populations, neglecting the main problem of rural population; it gives priority to a curative, hospital-centered medicine, which is less effective and of greater cost, with lesser development of preventive actions. What is more important, its services are discriminated by social groups, so the people in more need of care, receives less services, if any (11). The World Health Organization has emphasized the need to extend and improve the primary health care in the Third World.

The cultural determinants of mortality

62. The set of beliefs, values and behaviours in each culture may influence the child's survival and must be considered in the analysis of infant and child mortality in the Third World.

63. Cultural patterns affect the selection and interpretation of variables in the research design. It has been pointed out that the peasant family in many places of Africa and Asia is extended, patrilineal, patrilocal and patriarchal, and completely different to the occidental nuclear family. The different types of families are associated to different social behaviours influencing demographic variables. It has been emphasized the risk of approaching demographic studies in certain countries of the Third World using a frame of analysis corresponding to the western, industrialized world.

64. Beliefs on the life and the death of the child may also affect the quality of basic data. In some cultures, the dead child is supposed to be forgotten and his or her name should not even be pronounced. This may be the explanation of the purposive concealment of deaths found in some surveys.

65. The level of education, as mentioned before, has been shown closely and negatively associated with infant mortality in all studies, comprising a great variety of socio-economic conditions. Furthermore, it was found that once other socio-economic variables are controlled, education shows an effect "per se" in mortality, and greater than father's education. Caldwell has stressed that education is an important force in its own right, beyond its correlation with socio-economic improvement. There is little information to explain the nature of the education/mortality association. Education increases knowledge and skills, as well the ability to deal with new ideas. Educated mother breaks with tradition, becomes less "fatalistic" about illness and care of the child; she is more likely to look for proper health assistance. Caldwell emphasizes that the main factor is apparently that education changes the traditional balance of familial relationship and has more weight in the familial decision-making process related to the care of their children (Caldwell, 1979).

66. In many populations of the Third World, traditional medicine is still the only one accessible to the population. In order to study the mortality prevailing in these areas and to be able to extend the use of modern medicine, it is necessary to investigate beliefs and attitudes concerning (a) the care of the child (especially, feeding), (b) the perception of diseases and the beliefs on its causes and treatment, and (c) to whom they turn when sickness has occurred.

67. The value assigned to the life and the death of the child is another relevant factor. In certain cultures these considerations of value mean material advantages for the people and for males within the extended family. This seems to explain the higher female mortality in early childhood and a different omission by sex in the declaration of deaths.

68. The breast-feeding practice has also an important cultural background and is associated to the risk of death of the infant as well as the distribution of deaths during the two first years of life. Furthermore, the fertility, affected by numerous cultural characteristics, influences also early mortality.

69. It is important to remember that cultural determinants should be considered in the historic socio-economic context already mentioned. Although the scope of individual and family decisions is undoubtedly important, it is certainly influenced by conditions generated in that general context.

70. The way to include cultural factors in the explanatory study of mortality is a subject that should be discussed. They are contextual variables, of qualitative nature, and certainly changing from a community to another. It is another example of the multidisciplinary nature of the mortality analysis. At the meeting of Chaire Quetelet, 1979, attention was called upon difficulties in the team-work of demographers and anthropologist. Anthropological research has a local character, with a deep study of local communities, in contrast with the more general purpose and the use of rather big populations in demographic research.

In summary

71. In the preceding text it was attempted to systematized the large number of factors influencing child mortality in order to find an approach to the study of infant and child mortality in the Third World. For these purposes, they have been grouped in three categories: the historical socio-economic context, the governmental social policies (with special consideration of health) and the cultural determinants. By all means, this categorization is subject to discussion and improvement. As all analytical classification of a complex problem, it has to be understood that these categories are not independent and that they have numerous interactions. It is also clear that the process of change is very dynamic, and it shows a number of variations in the realm of the Third World. The experience that the participants Centers have in different regions, provides in this sense a favourable condition for cooperative studies.

Methods of analysis

72. Different research designs have been used in the explanatory study of mortality (Preston, 1978).

73. The most usual design is the cross-sectional analysis using "found" data sets. In different analytical units (countries, geographical units within countries, families) mortality is estimated and indices of factors considered determinants of mortality are selected. By means of several types of multivariate analysis it is estimated the independent effect of each variable on mortality. This type of research has provided meaningful contributions to the causal interpretation of mortality. Nevertheless, has important practical limitations. Independent variables are usually restricted and indices used are only a rough measuring of the explanatory variable, and bound to errors in basic data. Very often no information is available on some of the most significant factors determining the mortality. On the other hand, multivariate analysis show associations between variables which are not necessarily causal ones. It is also known the difficulty of giving a prospective interpretation to cross-sectional analysis (12).

74. The follow-up observation of a given population, registering the occurrence of deaths and the factors that may influence its incidence, at community, family and individual level, provide a richer material of analysis. Basic data are more reliable and explanatory or intervening variables may be better selected. The Cholera Research Lab research in Bangladesh, the WHO mortality surveys, the INCAP nutritional studies in Central America, among others, are examples of this type of research. Certainly, these are more costly research and of more specific value.

75. There are a few studies where the effect of health intervention on mortality has been evaluated, comparing populations similar in other determinant factors, but differing in the health care provided (Caldwell, 1975, for example).

76. It seems important to discuss several aspects of the design and interpretation of explanatory studies of infant and child mortality, such as: criteria to select and operationalize the variables, analysis at micro and macro level, use of different types of multivariate analysis, procedures to incorporate contextual variable to the analysis, etc.

IV. CONSEQUENCES OF THE INFANT MORTALITY DECLINE ON FERTILITY

77. The effect of levels and trends of child mortality on fertility has been a subject of much research, because population growth implications of mortality decline depend on the extent to which they induce corresponding reductions in fertility. The CICRED Seminar on "Infant Mortality in Relation to the Level of Fertility" (Bangkok, 1975) examined the following main questions: How much do fertility rates change when mortality changes? What conditions affect the responsiveness? How rapid a response can be expected? The general conclusion was that mortality decline is likely in all societies to increase rates of population growth, since some compensating fertility declines will rarely be sufficient to completely offset the growth effects of mortality change.

78. Child mortality (1-9 years) affects fertility through four main mechanisms:

- a) The compensatory response of fertility to changes in infant mortality resulting from the ovulatory-suppressant effect of breast-feeding resulting in longer average intervals to the next birth if the previous child survives the breast-feeding period than if it dies therein.
- b) The volitional replacement effect if parents aim to have a certain number of surviving children at the end of the childbearing period, which is assumed to be known, and if they could control fertility. Then, each dying child would be replaced by a live birth.
- c) The insurance effect, a reaction to future child deaths if parents aim at having a certain number of children at some point past the end of their reproductive period.
- d) Societal responses, that is, social reorganizations induced by mortality decline that operate on fertility by changing the reproductive context faced by individual couples.

79. It was recognized that existing methodologies are inadequate for the study of responses of fertility to changing mortality at the aggregate level; since they are not sensitive to the many social available options for responding to population pressures, considering social and cultural influences on the option adopted. The emphasis for future research was on the study at the level of intermediate variables of family system, and on the interrelations among levels of health mortality, socio-economic development and contraceptive availability as determinants of fertility levels.

80. Some of the main suggested areas of future research are the following:

- a) The relation of lactation, nutrition and ovulation, to understand why the difference in birth intervals associated with a surviving child, as opposed to a dying child, varies so much among populations.
- b) Research on other possible sources of shortened birth intervals following child births in natural fertility populations.
- c) Estimation of the size of the replacement effect in populations with a wide range of socio-economic, cultural, familial and contraceptive technological circumstances, aiming to determine at what stage of the fertility transition the effect starts to operate and how it changes as the transition proceeds. It should be informed by theoretical considerations that place child mortality-fertility relations in a broad socio-economic context.
- d) Ideal data for study are prospective information considering variables such as fecundability, nutritional and health levels of women, child health practices of the family, urban-rural residence, social class, educational attainment, breast-feeding practices following each birth, history of contraceptive use, and family size preferences. The multivariate analysis should examine interactive effects, emphasizing the possibility of different responses by different groups in the same society.
- e) In order to predict the size of the insurance effect, it is necessary to have some indication of how parents value different numbers

of children and not simply to obtain information on "the" desired family size. It is also desirable to have some indication of the age span of parents to which survival of children is most salient.

- f) Empirically estimation of the size of insurance effects requires information on parent's perceptions of child-risks. Community level of mortality may serve as a proxy for these perceptions. If it used in this fashion, the number of communities represented should be large and other community-level variables controlled.
- g) It deserves investigation the hypothesis that, when mortality declines, the number of surviving children demanded rises because the utility of additional children increases and their cost decreases.
- h) Emphasis in future research should be placed on the interrelations among levels of health and mortality, socio-economic development and contraceptive availability as determinants of fertility levels.
- i) Methodology, data and theory all need development, if work on the subject is to advance much beyond the level reported at this Seminar. The continued development of indirect and relatively inexpensive measures of mortality and fertility in particularly to be encouraged.

81. It is worth to stress that several general recommendations done in the discussion of the influence of child mortality on fertility are equally pertinent to the design and interpretation of the studies of the determinants of that mortality. It is also clear that many investigations could aim with profit to study both problems. Some of the most important points are the following:

- a) The need to develop a theoretical frame of analysis.
- b) The importance of considering the socio-economic and cultural context in the design and interpretation of studies.
- c) The wide range of variation of this context among countries and among regions within countries of the Third World, and the need and advantage of study the problem in the varying and changing conditions where it is occurring.
- d) The limitations of the analysis at the aggregate level and the problems of interpretation of multivariate, cross-sectional analysis.

- e) The advantages of the micromanalysis at the family level, where important intermediate variables and mechanisms are operating, and the importance of longitudinal studies.
- f) The need of a continued improvement in data collection and indirect methods of estimation and analysis.

V. SUGGESTIONS FOR THE CICRED INTER-CENTER COOPERATIVE RESEARCH PROGRAM

82. In the preceeding chapters it has been pointed out several research areas in the study of infant and child mortality in the Third World.
83. Considering time and resources available, the contribution of the inter-center cooperative research program to the study of the problem has some restrictions. It seems that it should consist mainly in the full use of the experience of the Centers, taking advantage of the numerous in-process, future and finished researches. A list of these researches, as reported by the Centers, has been compiled.
84. Some suggestions of specific projects for the program are described in the following text.

A comparative mortality study in selected populations

85. Factors that determinated the mortality transition occurred in the past in industrial advanced countries have not been completely clarified and are a controversial subject. That is why it is an exciting matter of study the transition of mortality occurring in the Third World, in order to find out the factors fostering or hindering a decline of mortality and how do these factors operate, in order to promote the former and to control the latter ones. The very fact that the process of transition is found in different phases and that probably has different patterns of development among populations of the Third World, opens stimulating perspectives for a comparative study in this context.
86. Surely, the process of mortality change occurs under very different conditions in the Europe of the past and in the Third World of today. The possibilities of controlling the natural environment and the technological progress in production, as well as the availability of means for the prevention of death, are giant today as compaired to the past (13).

87. The study of infant and child mortality using all the available information in the Third World has provided important findings, but it is of limited explanatory scope, as shown by the recent report of United Nations (Population Division) and World Health Organization, due to the lack of information in many populations and the variable quality and coverage of the information.

88. That is why it is suggested instead a comparative but limited study of selected number of populations (mainly countries) having the following characteristics:

- a) Populations with different levels of infant and child mortality, representative of the different stages of the transition from a high to a middle level mortality. In addition to the level, some other features of mortality may be considered, such as trends.
- b) Populations experiencing different stages of the process of socio-economic modernization.
- c) Populations where a minimum of basic data is available for the study. It should be avoided, however, the exclusive selection of populations where the information system is better, condition usually associated to lower mortality and less under development.
- d) Populations representative of the several conditions existing in the Third World with respect to infant and child mortality.

89. Within this frame of reference, it is possible to consider also contrast of particular importance. In the Chaire Quetelet meeting it was mentioned that Sierra Leone has less poverty than Bangladesh, but a higher infant mortality. Blacker mentioned the interest of comparing Kenya and Gambia, where information is available and infant mortality is quite different.

90. In the selected populations, all the available information would be examined (and evaluated) on levels, trends, differentials of mortality, using all the independent variables existing for analysis (14).

91. According to the ideas summarized in Chapter III, the information on those populations would be completed with reference to (a) the historic stage of socio-economic development, (b) the existence of social policies affecting mortality (health, in particular), (c) the relevant cultural characteristics. In this way, the explanatory analysis will be enriched with a broader set of variables than the usually considered in this type of research.

92. As far as possible, the study should consider both the macro and micro level of analysis.

93. Because the wide range of mortality situations considered in the project as well as the broader number of explanatory variables collected, it is to be expected that this comparative analysis will provide a more comprehensive approach to the study of infant and child mortality in the Third World. The central idea is that the joint examination of a set of well selected researches should provide more information than the single consideration of each of them.

94. The main difficulty of this project is the comparison of mortality estimations and other variables obtained from a variety of sources and with different methods. The restriction of these conditions should be carefully evaluated in the comparative study. Perhaps would be convenient to do some of the comparisons between researches based in similar sources and methods, in order to reduce this disparity factor.

Evaluation of indirect methods

95. The Brass-type methods have been extensively used, but evaluations of its results are much more limited. Although the method provides mortality estimations less reliable and with less detail than the multiple-round surveys, it remains as a practical option as long as civil registration does not improve substantially. The population censuses of the next decade will provide a wide field of application to these methods. It is urgent, therefore, to have a more complete evidence about its scope and limitations in the study of child mortality in the Third World.

96. The evaluation may have the following purposes:

- a) To measure the error of estimations when the mortality structure is different of the model life tables used and to find alternative models that might be used. Simulation and empirical research is needed for this purposes.
- b) The frequency and distribution of the errors in the declaration of children ever had and surviving children, its causes, and its effect in the mortality estimations.
- c) The reliability of indirect methods in the analysis of mortality differentials.
- d) In general, the robustness of indirect methods in the conditions of application required for studying child mortality in the Third World.

97. The evaluation requires the comparison with information provided by multiple-round surveys or reliable vital statistics.

98. It has been mentioned the availability of new methods of indirect estimation of mortality. The empirical evaluation of these new methods may be also considered, as well as more theoretical work to improve this field.

Particular age-structure of mortality

99. In some tropical countries it has been described a special age-pattern of mortality, where high mortality in the second semester of the first year of life is extended to the second year, mainly. Cantrelle has emphasized the need to investigate its frequency and origin, its relation to causes of death, duration of breast-feeding, cultural patterns, etc.

100. The study of this problem requires data from multiple round surveys.

The mortality surveys developed by World Health Organization in several countries and the mortality surveys conducted by I.F.O.R.D. are increasing basic data for this purpose. A collaborative study of this and other sources may provide a significant contribution to this problem.

The causes of death

101. As already mentioned, the study of the causes of death in infancy and early childhood is important to explain the characteristics and differentials in that mortality, as well for determining the scope of maternal and child health program. Few of the Centers research deals with this subject.

102. It might be considered that the inter-center program promotes and participates in a collaborative study of the restricted sources of information already available. Some of this sources are the following:

- a) Countries or regions within countries - where the civil registration is acceptable completed.
- b) Chile has a reliable vital statistics system that has permitted to study the causes of infant mortality in relation to parents education, father's education, birth order, age at death, etc. in the cohort of 1972 births (Taucher, 1978).
- c) World Health Organization mortality surveys are aiming to investigate causes of death.
- d) In three Central American countries there exist a system of surveyance of infant malnutrition, with the collaboration of the INCAP (Institute of Nutrition for Central America and Panama). INCAP has several studies where demographic variables are considered in the study of prevalence and mortality by malnutrition. INCAP has informally expressed its interest in collaborative studies with demographic centers.

103. Some of the subjects that may be considered in relation to the structure of causes of death are age, place of residence (urban, rural), availability and utilization of health services, education and other socio, economic and cultural contextual variables.

Effect of health programs on mortality

104. The evaluation of the effect of health programs on infant and child mortality is not simple. The effect of health interventions has to be separated from other components of socio-economic development, with which health care is frequently associated. On the other hand, there is a great variety of situations concerning the epidemiological transition of early life mortality and the development of health care among the populations of the Third World. In countries where mortality is high, socio-economic conditions are very unfavourable and health services are very limited, the main question is how much improvement in health and in mortality could be achieved with an organized primary health care covering the majority of the population, developed with limited professional personnel and health resources, and mainly carried with non-professional aid and the full participation of the community.

105. Multivariate analysis using rough indicators of health (such as doctors per population) cannot give a proper answer to this question. The research required must be developed with the participation of health experts and apparently goes beyond the possibilities of the inter-center cooperative program.

106. Perhaps it might be feasible to collaborate with cooperative studies aiming to evaluate the programs carried on in certain countries, in the above mentioned conditions.

The experience on mortality surveys

107. Multiple purposes demographic surveys and mortality surveys will continue to be an important source of information on mortality in many region of the Third World. Several methodological aspects of these surveys, especially in the important subjects of sources of errors and techniques to reduce them, have been published. Perhaps it is convenient to discuss whether further work should be done in this field.

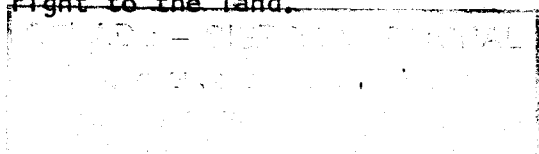
108. There are other aspects of demographic surveys that have apparently received less attention, being important factors in the quality of the collected data. Perhaps the experience of the Centers may be analyzed in relation to (a) selection and operationalization of variables, (b) formulation of questions, (c) selection and training of interviewers, (d) control procedures, etc.

August, 1979

FOOTNOTES

- (1) It has been reported in Sri Lanka that the female surmortality covering ages up to 44 years in 1945-1947 is no longer observed in 1971, but it remains at ages 1-9 years (UN/WHO, Levels and Trends in Mortality since 1950, January 1979, Chapter on Asia).
- (2) However, in some Asian countries it has been observed that neonatal mortality includes more than half of the deaths under one year of age (NU/WHO, Levels and Trends in Mortality since 1950, January 1979, Chapter on Asia).
- (3) In a study covering 12 Latinamerican countries, it was found that 3 per cent of national births occurred in women with higher education belonging to urban population, mostly residing in the national capital. These children were exposed to a risk of dying less than 40 per 1000 births and generated only 1 per cent of total deaths under 2 years of age. On the opposite, 50 per cent of births occurred in women of very low education or illiterate, the majority living in rural regions. The mortality in this group was as high as 120-200 per 1000 births and produced 67 per cent of total deaths under two years.
- (4) "Since mortality is inversely related to socio-economic status, it stands to reason that the most effective way to reduce mortality is to reduce the socio-economic differences within population. However, it is not clear that the differentials have been getting smaller as general levels of mortality have declined. There is some evidence that the nutritional problems in parts of Asia are far from resolved and that the proportion of populations living below the "poverty line" is increasing. It also appears likely that mortality differentials between population sub-groups will get larger despite the successful implementation of public health programmes and programmes to control some of the major endemic and epidemic diseases. Increasingly, high mortality is manifestly a class problem - a problem of poverty, poor nutrition and ignorance" (UN/WHO, Levels and Trends of Mortality since 1950, January 1979, Chapter on Asia).
- (5) A system to identify social class has been elaborated by Campanario and applied to a fertility survey in Costa Rica (González, G. et.al., Estrategia de desarrollo y transición demográfica: el caso de Costa Rica. CELADE, Noviembre 1978). Behm has tried an approximation to social classes using the population census information on occupation and occupational category (Behm, H. y Guzmán, J.M., Diferencias socio-económicas en el descenso de la fecundidad en Costa Rica, 1960-1970, CELADE, Serie A No. 1040, 1979). A discussion of methodological problems of social class classification for demographic use may be found in Torrado, S., Clases sociales, familia y comportamiento demográfico: orientaciones metodológicas. Demografía y Economía (México), Vol. XII, No. 3, 1978.

- (6) "The demographer must have above all endeavor to explain a demographic phenomenon as a social fact, explain population events within their social, and institutional contexts". (Tabah, L., quoted by Concepción, M., CICRED Meeting of Directors of Demographic Centers, Mexico, 1977).
- (7) Amegandjin and Fargues have pointed out that the extensive use of surveys and adjustment techniques in Africa have a negative aspect: it has postponed a deep analysis of demographic phenomena and its relationships with socio-economic organization in Africa. (CICRED, Meeting of Directors of Demographic Centers, Mexico, 1977).
- (8) "Widespread poverty, the lack of education, and poor nutritional, sanitary and health conditions interact in such a way as to make mortality reductions inordinately difficult. Whether or not all of these problems can be overcome in the absence of economic development is debatable. However, it would seem to be clear enough that the involvement of the people themselves is essential and that an adequate administrative infrastructure and determination on the part of the government to use its power to bring about fundamental social change are equally important. Some social reorganization and redistribution of wealth would seem to be required if the poor are to escape poverty, to be made literate and to be assured of an adequate diet - three prime requisites to reducing mortality to low levels". (UN/WHO. Levels and Trends of Mortality since 1950, January 1979, Chapter on Asia).
- (9) It is interesting to remark that the historic experience of today advanced countries shows that infant mortality was one of the age groups most resistant to the decline. Significant declines were observed only at the end of XIX century or on early XX century. In a similar way, in Latin America early child mortality has achieved greater and more continuous decline than infant mortality.
- (10) The socio-economic condition in the agricultural sector of Latin America has been recently examined by the Economic Commission for Latin America (ECLA) and it is probably valid to a certain degree for other regions. The ECLA report points out that the problems of food, employment, income and living conditions have not been solved and, sometimes, they become worse. This situation does not depend on an insufficient expansion of production nor of the permanency of traditional agrarian structures, but they depend on the way in which the capitalist transformation of the sectorial productive system takes place: development of a sub-sector of modern agriculture, formed by a small number of medium and big enterprises, which concentrate the technological progress and the ownership of the land, and are connected by commercial, agro-industrial and financial mechanisms with the national and international market. As a result of this, the small producer has joined the salary earner to conform the majority of the rural workers of low income. The development of an agro-exporting sector has relegated the production of food for internal consumption to the more traditional sector, so generating the need to import food and creating a new dependency on the international market. Agrarian reforms have been limited and the farmers have not been able to organize themselves in order to defend their right to the land.



- (11) "The majority of African countries are still operating health programmes based on the "outmoded" institutions left behind by the colonialists; institutions which cater for the needs of a small number of people to the detriment of a large chunk of the population. It appears therefore that economic growth is not benefiting the needy and with the size of the marginalized groups increasing the poverty gap is being widened and inequality and dehumanization are on the increase; the poor are finding it more and more difficult each day to have an access to basic necessities of life including health facilities. Thus, policies aimed at correcting this urban-rural structural imbalance as regards provision of health services will contribute a great deal to the formulation of a better health programme that aims at satisfying the health needs of a large section of the population" ... "The future trends in mortality in tropical Africa may depend more than they have in the recent past on economic and social development, and a concerted effort should be made to extend preventive medicine and public health services to reach the majority of the population, especially the rural folks. For the meantime, however, the traditional medicine will continue to permeate the lives of many Africans far beyond the year 2000", (Gaisie, S.K., 1979).
- (12) Gerard has raised an interesting criticism to the logic usually applied in these studies. Independent variables are considered automatically as explanatory variables. Variables are selected on the basis of common sense and the hypothesis do not always consider differences among populations. If the expected relationship and sign is found, the hypothesis is considered validated. If not, the author is usually inclined to try to explained why the expected results were not found. (Gerard, 1979).
- (13) On the other hand, while socio-economic development in Europe was favoured by the contribution of extended colonial dominions and the control of international markets, development in the Third World is essentially dependent of central economics. "Insofar as economic and social policies are concerned, it is clear that the internal policies of individual governments are often shaped by external forces. In particular, the attitudes and policies of the major world powers can profoundly affect domestic policies. Aside from ideological considerations, perhaps the most important outside influences relate to trade and finance, and the question of the relationship between these and the health status of the population deserves careful study. Major lending institutions are notorious for attaching conditions to essential loans to less developed countries which effectively hamstring the recipients" ... "It is clear that such external influences could easily account for failure of many less developed countries to accomplish more in reducing widespread malnutrition and the numerous preventable diseases during the past decade or more. In this way they undoubtedly form part of the explanation for the apparent and real slowdown or halt in the improvement in life expectancy indicated in the discussion above". (UN/WHO, Levels and Trends of Mortality since 1950, January 1979, Chapter on Asia).

- (14) It has been said that in several countries there are sources of data which have not been fully exploited or researches that have not been published. Unpublished research of students in some Centers are other possible source of information. These and other possibilities may increase substancially the inventory of researches mentioned by the Centers.

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