SOME APPROACHES TO THE MEASUREMENT OF POPULATION CHANGE IN AFRICA

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This paper reviews the recent development in the collection of demographic data for African countries and outlines their limitations. Some alternative, unconventional approaches to data collection such as the experiments involving household sample surveys, panel longitudinal studies, population laboratories, sample registration system and record matching studies are suggested. The countries of the region may choose the methods suitable to them on the basis of considerations of financial resources, availability of skilled manpower etc.

INTRODUCTION

The need for measuring population change and its components is keenly felt in Africa in the context of making population estimates and projections needed for planning and policy making. There have been several evalutions of African demographic data and the common conclusion that emerges in these evaluations is that the data available thus far are not adequate for measuring current population changes[1]. Neverteless there have been considerable progress since the evaluations were undertaken, largely through censuses and sample surveys carried out in several countries of the region. It is of interest to examine these developments and to consider how these could be augmented by special procedures suited to African conditions. The focus of this paper will be on some unconventional approaches to data collection which could be adapted to African conditions with considerable advantage. These approaches have been tried else where with different degrees of success and their experimentation in the African conditions could be a great challenge and an opportunity to demographers in Africa[2].

The conventional approaches to data collection that are widely employed are consuses and civil registration systems. Only about two thirds of the African population is covered by a regular census, and some countries still depend upon «administrative» enumerations as their main source of demographic data. In the course of the discussions at the Addis Ababa Seminar in 1969, it emerged that some African countries are still faced with difficulties in organizing censuses and their policy was to modernize the «administrative» enumerations. The funds as well as manpower available for undertaking censuses are limited, and the consuses could at best be carried out once in ten years. In addition there are difficulties in the application of sophisticated international standards and therefore the world recommendations for the 1970 Population Censuses have been modified to suit the African conditions. While these efforts to undertake more and better censuses will have to continue, it should be noted that the conventional census procedure does not generate any direct information on current changes in vital rates, although they provide useful information for estimation of demographic measures for the intercensal period.

Vital registration in the sense of a continuous and complete recording of vital events as they occur is limited to only a few countries representing approximately one-third of the total population of the region. Although Uganda, Zanzibar and Madagascar have had systems of «compulsory» vital registration in force since the beginning of the century, there is considerable under-registration of births and deaths and it is quite impossible to base estimates of rates of population growth on the registration figures. In the Commonwealth countries of West Africa some of the cities and large towns register most of the births and deaths which take place within their administrative boundaries. In some countries, vital registration is complete in respect of a part of the country (for example in the Tananarive province of Madagascar), or in respect of particular sections of the population (for example for the European populations of Zambia or Malawi). Such statistics are of limited value to the demographer for measuring current population changes of the countries concerned. Complete and accurate civil registration should be the ultimate goal, but it may take a decade or more before this is achieved.

Experiments Involving Household Sample Surveys :

In the absence accurate civil registration systems, many countries have resorted to household sample surveys for measuring current vital rates. Such surveys provide information for over four-fifth of Africa's

population. In some countries they are employed in the place of complete enumeration, while in most countries they supplement information from censuses. While the sample survey method has the advantage that it can be carried out at lesser cost with fewer enumerators than that required for a census, it suffers from the same limitation as the census since it does not generate information on current changes in vital rates unless the surveys are repeated at intervals of time. However, as indicated in the subsequent paragraphs a wide range of approaches could be employed in the household sample surveys and also a wide range of subjects that could be covered.

The simplest kind of household sample survey is the repetitive enumeration at regular intervals of all the households in selected «clusters»[3]. Villages and parts of towns constitute the «clusters» which could be conveniently selected after stratification of the distrists according to some ethnic or geographical characteristics. Samples of 50 to 100 such clusters with a population of 25,000 to 50,000 will suffice to give reasonably good estimates of vital rates. In the first round of such repetitive surveys, more detailed «baseline» information may be obtained for every household, and in the subsequent rounds only the changes in the households since the previous visit need be collected. The major advantage of such repetitive surveys is the fact that the «boundary effects» can be reduced to a minimum.

An improvement over the simple repetitive survey mentioned above is the repetitive survey with overlapping «recall periods»[4]. It was found that as the «recall period» of the survey is increased there is progressively greater omission of vital events. The relationship between the «recall period» and the vital rates could therefore be used as the basis for estimating the «true» rates[5]. Moreover, as noticed in the Indian National Sample Survey the lengthening of the reference period from one to two years with a breakdown into two one-year recall periods improves coverage in the reporting of last year's events. An ideal approach will be to have a round of the survey once every six months eliciting each time the events during the preceding twelve months. Such a survey could be implemented as a part of a larger multi-purpose survey covering economic and social aspects.

There are four alternative ways in which the repetitive survey may be undertaken :

1. An independent sample may be selected every time.

2. The survey may be repeated on a fixed sample.

3. Part of the sample may be replaced on each occasion, the remainder being retained. For example, one-third of the sample may be replaced each selected unit being retained for three successive rounds.

4. The second and subsequent rounds of the survey may be on a subsample of the original sample.

The choice of the procedure would depend upon the relation between the variability of the units and the variability of the changes in these units [6].

Several experimental approaches could be built into these sample enquiries to detect errors in the demographic data of these countries, and to develop better methods of obtaining information on vital rates and demographic characteristics. For instance, a simple experiment could be to find out whether female enumerators prove more «efficient» in eliciting information than male enumerators, whether enumerators resident in the villages are more efficient than outsiders, whether six-monthly rounds of interviewing is better than annual rounds. Like wise, several methods of ascertaining age can be experimented in different subsamples and the distributions could be campared. These examples illustrate the flexibility of the survey approach in the development of procedures for obtaining more reliable information on the dynamics of the poulation in Africa.

The Population Laboratories (POPLAB) Approach :

The concept of the POPLAB is a relatively new idea developed by Forrest Linder [7]. This involves the selection of a specific geographic area for which maps and houselists are maintained, and data on vital events, marriages, migration and on socio-economic factors are collected on a continuous basis. This approach is employed in Gandhigram (India) for watching the progress of the family planning programme in the «LAB area» [8]. The advantage of this system is that information on the numerator of vital rates (number of births, deaths, marriages, infant deaths etc). and the denominator (population size, number of persons of specified sex and age, number of livebirths etc.) can be obtained from the same source. In its highly developed form the POPLAB will approximate the continuous population registration system found in Scandinavian countries, Japan and Taiwan.

To begin with, each African country could develop one POPLAB of approximately 20,000 population where the system of registration of births, deaths and migrations could be perfected through the use of the «multiple-feeding» approach. In this approach the vital events are recorded by several informants and then pooled together avoiding the duplication of the same event. Likewise a carefully planned and implemented enumeration will provide the baseline information required for computing vital rates. Eventually two or three such Laboratores could be develped so as to provide meaningful comparisons, and to provide a more representative picture of the demographic situation in the country. The advantage of this approach is the concentration of the efforts in a limited area which enables better supervision at the time of data collection, besides it is possible to undertake a number of special studies in the LAB area. To cite a few examples of methodological nature, the POPLAB can help in the estimation of «recall» and «boundary» effects in retrospective surveys for measurement of vital rates, to estimate the extent of completeness of births, deaths and infant deaths in interview surveys and for comparison of the longitudinal and cross sectional studies in the measurement of population changes.

Panel Longitudinal Studies :

This method involves the selection of a panel of persons according to some specified criteria (for example, currently married women between the ages of 15 and 44), and making periodic observations by repeated interviews or by other means. A good example of the panel longitudinal study is the Standard Fertility Survey carried out in India since 1965, where a panel of approximately 3000 women were followed for a period of five years at intervals of six months and changes pertinent to each person in the panel (for example, pertaining to marital status, prognancy history, number of living children, menstrual status etc.) were recorded [9]. This method involves many difficulties from the operational and analytical point of veiw, the most important of which is the treatment of the «lost to follow-up» cases. Besides, there is the difficulty in determining the base population for computing the vital rates. Nevertheless, there are a few advantages in this approach such as the rapport with the panel members which will enable the interviewer to get more accurate information and the repetition of the enquiry on the same households could help reduce the «boundary effects». It will be ideal to combine the panel study with periodic cross-sectional surveys where resources permit.

Sample Registration System :

Where the conventional registration systems do not function efficiently due to inadequacies of organization, staff or resources, it is possible to combine continuous registration and frequent enumeration in a few places to obtain more realistic estimates of vital rates. This approach has been embloyed with advantage in India, Pakistan, Turkey and Thailand for arriving at the vital rates[10]. While such a scheme is widely under discussion in Africa, no country has to my knowledge instituted such a scheme. Usually, prior to the introduction of the scheme a baseline survey is undertaken to ascertain the number of households and the persons normally resident in these households in order to provide the population base for working out the rates. The baseline survey can be avoided if the scheme is started soon after a census, as the census enumeration itself will provide the baseline information.

The Sample Registration Scheme envisages a continuous enumeration of events in the sampled areas by the enumerator coupled with an independent survey at six-monthly intervals by the supervisor. The simultaneous use of census and survey methods helps in the detection of events missed by either method thereby enabling the unduplicated count of vital events. A sample of 100 areal units (villages or parts of towns) with about 10,000 households will be adequate for a given country. An enumerator may be stationed in each of the selected areal units for recording the births and deaths as they occur, and preferably he should avail the help of informants.

Record Matching Studies :

Record matching studies can be carried out if the records from more than one source of information is available such as censuses, surveys and vital statistics obtained independently of each other or enumerations are carried out by two invertigators independently[11]. The records from two independent sources (for example, sample survey against vital statistics) could then be matched to find out the number of cases recorded by both sources as well as those recorded by one source and missed by the other. From the above information one could estimate the number of vital events missed by both the sources by making use of the Chandra Sekhar-Deming Formula[12]. Apart from providing more realistic estimates of vital rates, this procedure helps in the evaluation of the different sources of data.

The disadvantage of this approach lies in the complex problems of matching. A recent study shows that as the number of characteristics on which matching is attempted is increased, the estimates of vital rates can rise to astronomical proportions[13]. Besides, there are no ways of determining what is an ideal match, and the procedure employed will have to be different for different countries. Record matching studies can be built into the procedures described earlier, for example by pooling the information available from civil registration systems and household enumerations in selected areas, as in the case of the PGE experiment in Pakistan.

Concluding Observations :

The methods outlined in this paper are only illustrative of the wide range of choice available to the countries of the region in the matter of collection of data on population change needed for planning and policy making. The choice of the methods employed in each country would depend upon the financial and manpower resources available and the organizational and institutional apparatus existing in each country for carrying out such data collection operations. Broadly one may recommend the following essential and optional approaches for countries of the region according to the state of development of their statistical systems :

	Essential	Optional
Countries with well-developed statistical systems and reasonably good vital registration	Annual Household Sample Surveys	Record matching Studies
Countries with well-developed statistical system and inadequate vital registration	Sample Registration Scheme with perio dic Hosehold samp-ple surveys	Record matching Studies
Countries with inadaquate statistical system	Population Laboratories with periodic household sample surveys	Panel longitudinal studies

The scope and content of the observations may again vary from country to country, but the aim should be to obtain, atleast, a reasonable estimate of the following :

(a) *Crude* birth, death, nuptiality, net migration and growth rates for the total poulation.

(b) Fertility rates for the female population by age.

(c) Death rates by sex and age.

(d) Migration rates by sex.

The scope of the observations may be eventually widened to include other aspects of population change such as rural-urban differentials, socio-economic factors associated with fertility and mortality, effects of changing patterns of nuptiality on family formation and changes in customs and their effects on population growth. Whatever method is employed, these studies have to be carefully designed and implemented in order to provide a meaningful picture of current population changes in the African continent.

ACKNOWLEDGEMENT

FOOTNOTES

(1) See F. Lorimer "Basic Demographic Information : Status and Prospects" in Frank Lorimer and Mark Karp (ed) *Population in Africa,* Boston University Press, 1960 ; Also E. Van de Walle, "The Availability of Demographic Data by Regions in Tropical Africa" and W. I. Brass, "The Improvement of the Quantity and Quality of Demographic Statistics" in John C. Caldwell and Chukuka Okonjo, *The Population of Tropical Africa,* Longmans, 1968.

(2) See W. P. Mauldin, "Estimating Rates of Population Growth" in B. Berelson *et. al., Family Planning and Population Programes : A Reviews of world Development* pp. 635—654 ; Also D. F. Heisel "Measuring current population changes" in John C. Caldwell and Chukuka Okonjo, *The Population of Tropical Africa,* Longmans, 1968, pp. 155—162.

(3) Examples of such surveys are the Guanabara-Cauquenes Study in Brazil and Sine Saloum Study in Senegal. See United Nations, *Guanabara Demographic Pilot Survey : A Joint Project of United Nations and the Government of Brazil* (New York : United Nations, 1964) ; also Pierre Cantrelle "Repeated Demographic Observation in a Rural Area in Senegal : Methods and First Results" paper presented at the World Population Conference, Belgrade, 1965.

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(4) Examples are the Moroccan Survey of 1961—63 and the Indian National Sample Survey since the seventh round. See G. Sabah and C. Scott, "An Evaluation of the Use of Retrospective Questionnaires for Obtaining Vital Data : The Experience of Moroccan Multi-purpose Sample Survey of 1961—63" and Murari Majumdar, "Estimation of Vital Rates in the Indian National Sample Survey" papers presented at the World Population Conference, Belgrade, 1965.

(5) R. K. Som, "On Recall Lapse in Demographic Studies", International Population Conference, Vienna, 1959.

(6) F. Yates, *Sampling Methods for Censuses and Surveys.* Charles Griffen and Co. London, 1960. p. 46.

(7) See *Laboratories for Population Studies,* Parts 1 and 2 issued by the University of North Carolina, 1968 ; also Forrest E. Linder, *The Concept and the Programme of the Laboratories for Population Statistics,* Scientific Series No. 1, The University of North Carolina, Chapel Hill, 1971.

(8) The Institute of Rural Health and Family Planning, Gandhigram developed two registers, known as the Enumeration Register and the Eligible Couple Register to provide uptodate information for the LAB area (Athoor Bloock).

(9) See *Standard Fertility Survey Manual* Prepared by the Central Family Planning Institute, New Delhi (1965 ?).

(10) See India, Office of the Registrar General, *Sample Registration of Births and Deaths in India,* New Delhi, 1970 ; Pakistan, Central Statistical Office, *Population Growth Estimation Procedure,* Karachi 1962 ; Nusret H Fisek *et al, The Turkish Demographic Survey,* Ankara : School, of Public Health, 1964 ; A Chintakananda and Patience Lauriat "Technique to Measure Population Growth : Survey of Population Change in Thailand" paper presented at the World Population Conference, Belgrade, 1965.

(11) Ansley J. Coale, "The Design of an experimental procedure for obtaining accurate vital statistics". International Population Conference, New York, 1961.

(12) C. Chandrasekharan and W. E. Deming "On a method for estimating birth and death rates and the extent of registration" *Journal of the American Statistical Association* Vol. 44 pp. 101—115.

(13) K. Srinivasan and A. Muthiah, "Problems of Matching of Births Identified from two Sources" *Journal of Family Welfare* Vol. XIV No. 4 June 1968 pp. 13—22.