The Follow-up Method in Demographic Sample Surveys

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PREFACE

The present technical report describes the follow-up method for gathering information on births, deaths and geographical mobility of a population in demographic sample surveys and for producing estimates of fertility, mortality and migration. As the report itself indicates, a variety of other methods have also been used to collect statistics and produce estimates on these topics, including civil registration systems, 1/ population censuses and surveys combined with methods of indirect estimation 2/ and one-time surveys using full maternity histories. 3/

Although the follow-up method has been widely used over the years, no systematic review of its rich body of experience has been made. Increasing interest is now being expressed in it by a number of countries undertaking multiround sample surveys within the framework of the National Household Survey Capability Programme. 4/ Accordingly, the present report endeavours to synthesize current experience in the use of the method, both in specialized demographic inquiries and as part of general survey programmes. The report was drafted by Mr. Vaino Kannisto, former Interregional Adviser on Demographic and Social Statistics of the United Nations Statistical Office, serving as a consultant to the United Nations, and was revised by the United Nations Secretariat to take into account the valuable comments from the United Nations regional commissions and other bodies.

In presenting detailed technical information on the follow-up method, it must be emphasized that no single procedure can be considered as the uniformly best approach to demographic measurement. Specific methods each have their own advantages and limitations and the trade-offs between them may vary among countries and among uses within a particular country. Indeed, the present report should be seen as supplementing and expanding upon the United Nations Handbook of Household Surveys 5/ and the United Nations Handbook of Vital Statistics Systems and Methods. 6/ Both of these Handbooks endeavour to provide technical information on a broad range of approaches to data collection and estimation in light of the varying needs and circumstances of countries.

The draft of the present report was first completed in 1984; revisions were made in subsequent years. It should be noted that a number of follow-up surveys, that were conducted during the 1980s -- for example, the Enquete demographique nationale of Morocco (1986-1988) and the National Demographic Survey of Laos People's Republic (1988 and onwards) -- are not covered in this report, in order not to delay its publication. Readers may wish to consult the relevant reports when they become available. 7/

Notes

1/ Principles and Recommendations for a Vital Statistics System (United Nations publication, Sales No. E.73.XVII.9).

2/ Manual X. Indirect Techniques for Demographic Estimation (United Nations publication, Sales No. E.83.XIII.2).

3/ For example, the World Fertility Survey of the 1970s and the Demographic and Health Surveys of the 1980s.

4/ National Household Survey Capability Programme Prospectus (DP/UN/INT-79-020/1).

5/ Handbook of Household Surveys (United Nations publication, Sales No. E.83.XVII.13).

6/ Handbook of Vital Statistics Systems and Methods, Vol. II (United Nations publication, Sales No. E.84.XVII.11).

7/ Royaume du Maroc. Direction de la statistique. Enquête démographique nationale (ENDPR 86-88). Rapport préliminaire. November 1989. The report of the Laos' survey is not yet available.

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Chapter I

THE FOLLOW-UP METHOD FOR MEASURING POPULATION CHANGE

Vital statistics and sample surveys

In a well developed and integrated system of national statistics, basic vital statistics are derived from the civil registration system. 1/ In countries in which the civil registration system has not been well maintained, the statistics it produces will be unreliable. In such circumstances, population censuses and sample surveys are often used to generate estimates of basic vital statistics. Such a situation persists today in many developing countries. In some of them although the registration of births and deaths has been compulsory for many decades it has not always been successfully enforced, so that its completeness remained unsatisfactory. In other countries, the registration of certain or all vital events is voluntary or is -- for the time being -- limited to only some parts of the national territory, such as the principal cities. While serving to some extent the legal needs of the population, the system therefore is not able to produce the basic vital statistics needed for monitoring population change and assessing a variety of health, population and development plans and programmes. 2/

Sample surveys can provide a wealth of demographic and related data to complement the basic vital statistics generated by the civil registration system. Indeed, they continue to have this function in countries where the civil registration system well fulfils its objectives. In the present publication, however, the primary concern is how to use sample surveys to obtain basic estimates of fertility and mortality levels and, secondarily, to obtain estimates of migration.

With regard to vital statistics, primary attention is given to collecting data on births and deaths and selected characteristics related to these events. Depending upon the survey design and its other objectives, the possibility of obtaining data on marriages and divorces also exists. With regard to the collection of migration data, surveys are best suited to obtaining data on in-migration. In the case of out-migration, surveys are not a particularly good data source when the entire household moves or the household breaks up as a result of the migration. However, surveys can provide reliable data on out-migration and the characteristics of out-migrants if at least a few of the household members remain after one or more members have moved.

To obtain a clearer overview of the different kinds of sample surveys used for collecting demographic data, it is useful to classify them into main types. Such a classification is often done on an operational basis, grouping the surveys according to whether the data are collected at one time or during several rounds or in a combination of field visits and current reporting. If, however, the distinction is made according to the method of

enquiry, the main types are:

(a) Retrospective method:

Single-round surveys;

Multiround surveys;

(b) Dual-source system;

(c) Follow-up method.

The retrospective method and the dual-source system are briefly described below.

The retrospective method of enquiry is by far the most often used. Being a very flexible approach, it is applied in the most varied forms and for the most varied objectives. It is usually conducted in a single round of interviews, but there are examples of subsequent survey rounds with (possibly) a different set of questions, sometimes applied to a subsample only. Some retrospective surveys have from the beginning been conceived as multiround operations, applying possibly the same questionnaire to the same sample but using the retrospective interview technique each time. It would therefore seem that the distinction between single-round and multiround surveys is not a basic one and would in some cases be difficult to make.

The procedures of the single-round survey were sometimes transferred to the multiround survey without essential alteration, and no new, promising avenues were opened. Since the multiround is more expensive and cumbersome and has the same inherent strengths and weaknesses as the single-round, it has not been applied often lately.

Retrospective questions may refer to the past experience of either a household or a person. In the case of a household, the reference period is always limited, most often to the preceding 12 months. In the case of a person, it may either be similarly limited or cover the entire lifetime. The method is also often used in a population census in which it has the same strengths and weaknesses as in a survey except that it is free of sampling error and usually from the shortcomings of an inadequate or obsolete frame also.

The retrospective method studies past experience from the accounts of survivors of that experience. Information on non-survivors -- the dead and the departed -- has to be collected from others -- in the first place, from relatives or household members. Sometimes there is no respondent left and thus no reference to the person in question. In household samples there is the further problem of who should report past events in households which have subsequently divided. Problems of household definition may weaken the enquiry not only through genuine uncertainties but also by providing convenient loopholes for those who seek them. The effects of such ambiguities should not be exaggerated, however, since they

are not likely to be very serious in a -- say -- 12-month recall period.

The retrospective method has been greatly invigorated in the past 15 years or so by the advent of indirect methods for the estimation of demographic variables from incomplete data, beginning with the now well-known work of Brass and others. 3/ Another impetus to the same approach has been given by the large-scale World Fertility Survey (WFS) which has developed its own distinct set of questionnaires, procedures and techniques, largely also based on the work of Brass and his collaborators. Fertility surveys, defined as enquiries based on and focused on the reproductive history of the woman and which of course have been carried out since well before the WFS, can be considered a subgroup of retrospective surveys or even a main group of their own. 4/

The new indirect techniques of analysis have been developed for the purpose of making the best use of incomplete data. At the same time innovative new questions, on such issues as orphanhood and widowhood, have been added to the survey tools in an attempt to cover such topics as adult mortality and migration, which had been unsatisfactorily served by earlier methods. All the techniques in question are purely retrospective, and the data can be collected in a single interview. Careful shifting of various pieces of the admittedly incomplete information and skillful interpretation of the evidence are expected to give a reliable demographic profile of the population in question, including approximate vital rates.

The dual-source system of data collection, like the follow-up method, records current instead of past events and endeavours to overcome the main weaknesses of the retrospective method -- namely, the omission of events and their misplacement in time. It is predicated on the theory that events missed by one reporting system may be picked up by another. The dual design expressly attempts independent, dual or multiple reporting of the same individual vital events, one source usually being an ongoing recorder subsystem, the other an independent survey subsystem. 5/ This system, which is suited for nation-wide or otherwise large-scale projects, is operated in a sample of areas where demographic change is observed on a current basis and is related to the enumerated population of the same areas. A detailed description of the system is given in Population Growth Estimation. 6/

The third method -- the follow-up approach -- likewise conceived as a remedy to the shortcomings of retrospective questioning, is the subject of the present report. It too was designed primarily for nationwide surveys and is almost always operated in a set of sample areas. It starts by enumerating the inhabitants of the sample areas and, through repeated visits, follows what happens to them.

Surveys using this method have had various names in the literature. A common designation has been "multiround survey", which, however, as pointed out above, does not express the essence of the method. The name "panel survey" may give the connotation of persons selected on individual grounds. Names like "continuous observation survey" and "household accounting method" are imprecise. "Prospective survey" correctly emphasizes the contrast with the retrospective method, but it is felt that "follow-up survey" gives a clearer

idea of how the method works.

The follow-up principle

The follow-up method in statistical investigation is a procedure in which a number of individuals are recorded, together with certain statistical variables, and, after a lapse of time, are identified and the same variables recorded again, and thus a basis is provided for statistical measurement, in individual terms, of the changes that have occurred in the population between the two dates. 7/ When applied to population studies, the follow-up enquiry will focus primarily on events of population change -- i.e., births, deaths and moves -- but may also record other changes -- e.g., in marital status or educational attainment.

The follow-up method has been long and extensively used in medical statistics. A continuous record may be kept of a number of patients who have received the same diagnosis or undergone the same operation or treatment, and the repeated observations are used for calculating survival rates, relapse rates or levels of various medical indicators. This medical experience has stimulated the search for a parallel method in population studies.

A study of this type can be carried out using nothing but the materials of an existing records system, even without the knowledge of the persons concerned. It may also be carried out on the basis of records from a remote historical past. The essential characteristic of the follow-up, in all cases is that starting from a certain point in time, it moves forward -- never back. Only in that way can it satisfy the requirements of the laws of probability on which the results are based. 8/ For example, if a person is found to have been erroneously omitted from the sample, the person will be admitted to the sample as of the date when found, but not retroactively. The person's survival up to that date must not affect the rates because, according to the rules applied, his or her death would not have been recorded either.

The follow-up method is therefore in direct contrast to the retrospective one: the occurrence of an event is not observed by tracing back from the surviving population but by going forward from the population living at a given date. Such an approach has a different conceptual base from the retrospective one: it starts with the persons who enter the time period in question rather than with those who have survived it. The initial universe is used as a frame in the sample. (What is said above of the follow-up method also applies to the dual-source system and a conventional civil registration system. One limitation of those approaches is their slowness. They can produce results only as time passes, while a retrospective question can encompass a long time period at once.)

In a follow-up of population change, starting with baseline data on a population at a given point in time, the changes occurring after that point are recorded at repeated interviews and incorporated into longitudinal records of each person in question.

The follow-up approach to demographic measurement was proposed and tested in

independent experiments in widely different parts of the world, starting in the middle and late 1950s. By the early 1960s it was, still independently, being applied in national-scale surveys in Asia, Africa and Latin America. Stimulus and cooperation for the surveys was provided separately by three main supporters: the Statistical Office of the United Nations Secretariat, the Latin American Demographic Centre (CELADE), and French development cooperation through the Institut national d'études démographiques (INED), Institut national de la statistique et des études économiques (INSEE) and Office de la recherche scientifique et technique d'Outre-mer (ORSTOM). A review of this survey activity is presented in the annex.

The main goal sought in the surveys was to estimate vital rates on the basis of data that would be as free as possible from the omissions that had been so noticeable in earlier surveys. By reference to a list of persons enumerated at a given, earlier date, it became possible in most cases to record successfully their survival or death and recording of those who were still alive at the next visit also became nearly complete. However, children who died soon after birth presented a serious problem until the practice of recording current pregnancies and following them through was introduced. The periodic updating of the lists of the population under observation brought about another benefit -- i.e., recording of in- and out-migration.

Reference to earlier documentation made it possible to place the events in the correct intervals between known dates and thus virtually to eliminate the border effect. 9/ When the interviewer records only additional items since the last visit, both ends of the period are closed and so, by design, no events are likely to be displaced into or out of the reference period. 10/

By using lists of the sample population, the method effectively eliminated out-of-scope events and established a strict correspondence between the numerator and the denominator of the rates for the entire sample as well as for any of its sub-groups. 11/ The same result is achieved, at least in principle, in single-round surveys and censuses but has been a major problem in dual-source systems. Strict correspondence between the numerator and the denominator lessens the effects of the weaknesses in the sample design, because the principal results are expressed in rates and ratios. 12/ Likewise, errors in the initial listing affect both the events and the base population in the same direction, though not necessarily to the same extent. Unless the shortcomings of the sampling frame or the errors and omissions in listing are both massive and selective, the rates and ratios are not seriously distorted.

The early follow-up surveys demonstrated the feasibility of the method in widely varying circumstances and often showed noticeable improvement, in data collected, over the retrospective method. They included, however, no measure of the completeness actually attained, 13/ although incompleteness was still obvious in many instances and strongly suspected in others. This lack of a measure of completeness has since been remedied by systematic quality control. This device, by improving the field performance, assessing the quality of the data and providing correction factors directly applicable to them, is considered

to be of decisive importance for the success of the survey. It has been, or is being, applied in a series of four national demographic follow-up surveys which form the main demonstration material of the present report.

Another drawback in the early follow-up surveys was that the information on deaths of the newborn remained almost as poor as in the retrospective method. 14/ This shortcoming can be corrected by recording current pregnancies and following them through delivery and the first year of life of the child. Since it cannot be expected that all pregnancies will actually be recorded, the pregnancy follow-up is handled as a study within a study, technically independent from it, though based on cases drawn from it. By effectively removing the possibility that an early death is simply omitted (it can still be misrecorded as still-birth), the method can give results on infant mortality and pregnancy wastage which are of unrivalled accuracy in survey experience.

The mobility of the sample population presents a two-fold problem. On one hand, migration itself should be measured, while, on the other, ways must be found reliably to record the vital events of the migrants. When migration is defined as change of usual residence (instead of a move of any type and duration), the follow-up method can measure its volume and the characteristics of the migrants more accurately than other survey methods so far used. For recording vital events, however, no fully satisfactory solution has been developed. The method explained below has been used in some surveys and ensures a good correspondence between the migrants and their vital events but at the cost of disregarding the open end periods of their stay in the sample area.

Coordination with general household survey programmes

A national statistical organization, apart from its coordinating role with producers of official statistics in the country, is usually also directly responsible for the collection of data in many fields, of which population statistics is only one. Such data may, to a large extent, be generated through sample surveys, and it is in the interest of the national statistical service to plan its survey activity in an optimal, coordinated way.

The best results are not often likely to be achieved by a single, large-scale, multipurpose national sample survey but rather through a continuous, long-term survey programme in which separate surveys follow each other according to a well-planned timetable which allows the best use of the data collection, data preparation and data processing arms of the organization.

A national household survey programme makes it possible to serve a multiplicity of study objectives in a coordinated manner. The optimum degree of integration between different survey objectives can be determined case by case. The programme may take the form of a common sample and even a joint questionnaire or the selection of different subsamples from a master sample or simply the use of the same field organization. Many of

the field operations may be single-round enquiries; others may be recurring. A demographic follow-up survey may well be integrated into such a larger national programme, because it is a recurrent operation which does not require full time around-the-year staff and because the length and timing of its semi-annual or annual interview rounds can be arranged with a certain flexibility. There may also be reason to apply the follow-up technique to other, non-demographic items.

The modalities of coordinating a demographic follow-up survey with a national household survey programme are discussed in chapter V, in terms of three successive degrees of integration: conceptional uniformity; operational coordination; and coordination of the samples.

Main features of the follow-up method

The surveys carried out in different countries for the measurement of population change by the follow-up method have differed a great deal in actual application (see the annex). In the present report, the method is presented in a form which was developed in the 1970s in Iran, Nepal and the Syrian Arab Republic and in the 1980s in Samoa, and in which systematic evaluation, including quality control, play a central role. It is based on the principle of simplicity in design. This stems from an appreciation that many intricate designs had proven unnecessary and cumbersome -- if not downright harmful. Overambitious targets have been avoided in order to concentrate on collecting robust data for the calculation of reliable national estimates of population change.

The following are the main features of the method employed in the four national surveys and which can be used as guiding principles where the method is applied.

(a) Objectives: reliable estimation of fertility, mortality and migration in a current time-frame;

(b) Population coverage: national;

(c) Sample coverage: usual residents of a probability sample of areas. In the course of the survey, permanent out-migrants are excluded from the sample and permanent in-migrants included in it;

(d) Sample size: relatively large, preferably not less than 40,000 persons;

(e) Sample type: compact cluster sampling of identifiable geographical areas. Cluster size, a few hundred persons;

(f) Primary sampling unit: census enumeration area is preferred. Segmentation of enumeration areas when necessary, for the attainment of a given uniform size;

(g) Sample stratification: urban and rural strata with systematic random sampling. Stratification otherwise only in special circumstances;

(h) Sample selection: at equal probability and with uniform sampling fraction leading to a self-weighting sample, whenever possible;

(i) Sample rotation: no sample rotation;

(j) Duration of survey: more than one year, preferably three years or longer;

(k) Periodicity of survey: preferably six months, possibly three or four months in urban centres. Staggering of each field round over a period of time;

(l) Employment of survey staff: permanent or long-term staff;

(m) Questionnaire type: a single household questionnaire covering all visits during a 12-month period;

(n) Data processing interval: annual processing directly from the household questionnaire;

(o) Special treatment of births and infant deaths: recording of current pregnancies and their follow-up through delivery and the first year of life of the child;

(p) Evaluation and quality control: through duplicate interviews in a subsample of households. Matching of the two sets of data and calculation of correction factors.

As mentioned above, other objectives may be pursued through ancillary enquiries carried out in connection with regular survey rounds on separate questionnaires and very likely addressed to subsamples. It is, however, considered very important not to complicate the basic design of population follow-up by incorporating directly into it new elements which might jeopardize its smooth functioning. Caution should also be exercised in adding new items to the household questionnaire, and experimentation should in general be done outside of the basic survey.

The demographic follow-up survey can also be coordinated with many kinds of household surveys and, more than that, incorporated into a national household survey programme. Considerable gains may be made this way in survey preparation, in operations management, in reducing the cost and in making the results more useful.

A comprehensive, updated discussion of household surveys will be found in the United Nations Handbook of Household Surveys, 15/ complemented by the technical study, Non-Sampling Errors in Household Surveys 16/ and the Prospectus for the National Household Survey Capability Programme. 17/

In the present report, the details of a demographic follow-up survey are presented in chapters II - IV in the light of applications in Iran, Nepal, Samoa and the Syrian Arab Republic. At the same time, solutions found and experience gained in follow-up surveys elsewhere are discussed when applicable.

Chapter V discusses the question of how a demographic follow-up survey can be coordinated with general household survey programmes. Chapter VI gives a summary of the advantages and drawbacks of the follow-up method in demographic surveys. The annex is an overview of demographic follow-up surveys since their introduction in the late 1950s.

Notes

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2/ Principles and Recommendations for a Vital Statistics System (United Nations publication, Sales No. E.73.XVII.9), chap. III.

3/ William Brass, "Methods of obtaining demographic measures where census and vital statistics registration systems are lacking or defective", Proceedings of the World Populations Conference, Belgrade, 30 August - 10 September 1965, vol. I. Summary Report (United Nations publication, Sales No. 66.XIII.5), pp. 88-89.

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Chapter II

SURVEY PLAN AND OPERATIONS

Determining the objectives

Although the follow-up method is equally applicable to country-wide surveys, small-scale sample surveys, and exhaustive studies of large or small entities -- the latter being well known in medical studies -- for demographic purposes, it was developed to fill in gaps in the knowledge of vital rates until current civil registration could produce the information at some future date. The method, as discussed in the present report, is therefore particularly well suited for relatively accurate estimation of population change and of its components (fertility, mortality and migration) during the period in question. It cannot provide in-depth information on any of the subjects. Although it was not primarily designed to study fertility and mortality differentials, those can be measured if the categories involved are large. The method is less well suited for the study of fertility behaviour, specific mortality conditions or causal relationships. It has been designed to collect data of maximum precision and to be as immune as possible to memory lapse, particularly the inability to remember dates reliably. Great care has been taken to keep the interviews short, easy and non-controversial, and the questionnaire concise. The survey can function as a frame for ancillary enquiries which specialize in any desired topic and are carried out in connection with it. It can also be combined in various ways with other large-scale surveys or incorporated into a national household survey programme which would use a common frame and a common organization and provide data linkage.

It is natural that the follow-up survey in its basic form should first and foremost include an estimation of current fertility and mortality, those being indeed the main justification for the method. In this respect it must be decided whether only national rates are required or whether rates for urban and rural and perhaps other subnational areas are required as well. It is also important to determine whether all of the rates are required annually or whether some of them may be produced over a period of years are sufficient. For example, if valid results are required annually for every province, instead of the country as a whole, the size and cost of the sample has to be multiplied by the number of provinces. In Iran, Nepal and the Syrian Arab Republic it was decided to collect enough data annually to obtain national, urban and rural estimates but to prepare provincial or regional estimates only every three years. In Samoa, the need for subnational estimates was very limited.

In addition to the crude vital rates, the objectives usually include age-specific fertility and age/sex-specific mortality rates and their usual derivatives. Construction of a life-table is usually a desirable objective and this also may be best obtained from similarly pooled data, because data for a single year may not be typical of prevailing mortality conditions.

Separate results may be desired for various population subgroups such as ethnic or

socio-economic groups. Marital fertility is often desired separately, as is fertility, according to parity (order of birth). As long as any group forms a sizeable part of the population and is not concentrated in a small geographical area, it will emerge quite well from the general sample, requiring only an extra question in the questionnaire. On the other hand, small and rare categories will not be sufficiently represented unless the sample design is particularly adapted to their capture, and to so design the survey is likely to create inconvenience and weaken the overall national estimates.

The present report also describes a special method, called pregnancy follow-up, which can be incorporated into a follow-up survey and which makes it possible to obtain abortion and late foetal death ratios and to calculate infant mortality with improved accuracy. Foetal and perinatal mortality can in this way also be included among the survey objectives.

Migration estimates can have their place in the plans because migration data are generated as a by-product. It will, however, be useful to consider carefully how high a priority migration should have among the survey objectives and what kind of data are required and in how much detail. The follow-up method can yield more accurate estimates of migration volume than most other survey methods, and it will produce them in a much more precise time scale than retrospective survey methods. Demographic and selected other characteristics of the migrants can also be produced with reasonable accuracy. In most cases, the level of migratory current between the urban and rural sectors can be measured, and for international migration approximate figures can be calculated. However, when it comes to estimating migration between, say, individual provinces, the size of the sample or at least the number of area units would need to be larger than has been the case in the surveys here discussed.

Below is given a list of statistical series which might be produced from a demographic follow-up survey. An asterisk (*) denotes a minimum list of series which can be quite easily produced in most circumstances and have been obtained in all or almost all the surveys of Iran, Nepal, the Syrian Arab Republic and Samoa. Other topics have been included in some, but not all of the four surveys, and the inclusion of them would depend on national needs and the size and design of the sample.

List of possible series for a national follow-up survey

Fertility

* Crude birth rate, national
* Crude birth rate, urban and rural
  Crude birth rate, subnational regions
* Age-specific fertility rates and derived indicators
  (total fertility rate, gross reproduction rate)
* Marital fertility rates
* Fertility by parity

* Fertility by level of education
  Fertility by socio-economic group
  Fertility by ethnic group

General mortality

* Crude death rate, national
* Crude death rate, urban and rural
  Crude death rate, subnational regions
* Death rates by age and sex
* Life-table, abridged
  Mortality by level of education
  Mortality by socio-economic group
  Mortality by ethnic group

Infant mortality

* Infant mortality rate, national
* Infant mortality rate, urban and rural
  Infant mortality rate, subnational regions
  Infant mortality for married and unmarried mothers
* Infant mortality by detailed age
  Infant mortality by education of mother
  Infant mortality by socio-economic group of parents
  Infant mortality by ethnic group

Foetal mortality (pregnancy wastage)

* Abortion ratio (either spontaneous or all abortions)
* Late foetal death ratio (still-birth)
  Ratios of total pregnancy wastage
    * national
    * urban and rural
      for married and unmarried mothers
      by level of education
      by socio-economic group
      by ethnic group

Migration

Internal migration, rates and volume:

    * in- and out-migrants by age and sex
      in-migrants by origin

out-migrants by destination
* net urban/rural
* urban-to-urban; urban-to-rural; rural-to-urban; rural-to-rural between regions
* rate by age and sex

International migration, rates and volume:

* net migration
* immigration
* emigration

More topics, such as nuptiality and divorce, and more variables can of course be added to the list, but even the inclusion in the same survey of all the items in the list above would usually be overambitious and might create problems both in questionnaire design and in the interviews. The follow-up surveys so far successfully carried out have been limited to fewer topics than listed. It should not be forgotten that if the overriding purpose of the survey is to obtain high-quality data on the levels of vital rates, a limit on the number of additional variables is imposed without overburdening the survey and jeopardizing it altogether.

There exists, however, the option of attaching specialized enquiries to the main survey. Those would be carried out in a subsample of areas or of households on special questionnaires 1/ either in connection with a regular survey visit by the regular interviewers or perhaps by other persons who have the required subject-matter qualifications. Topics of the most varied kind can be studied in this way -- for example: complete reproductive histories, employment, school enrolment; 2/ migration, illness and use of health services; 3/ nutrition and family planning and a wide range of census-type questions. 4/ Such ancillary enquiries would normally be limited to one single round each, which does not prevent linking the data with those of the main survey. In certain cases there might be reason to repeat such an enquiry after a certain period of time.

Scope of the survey

There is hardly any doubt that the unit of observation in the survey is the individual, even though household questionnaires are used and the sample is composed of area units. Accounts will be kept on the individual and on certain events which may happen to him/her: birth, death, move in, move out. The base population is measured in terms of person-years-at-risk.

All the surveys reviewed here have used compact cluster sampling: a sample of small geographical areas is selected, and the survey is then carried out in every household of each selected area. This raises a fundamental question, the same which is faced at every

population census -- namely, exactly who in those areas should be included: the usual residents or those who are found there at the time of the enquiry, or perhaps both? In an overwhelming majority of cases -- and this includes the four surveys examined in this report -- the answer has been given without hesitation: the usual residents.

There are many reasons, both practical and conceptual, for this decision. Information is generally easier to collect and more useful on the resident population than on the present-in-area population. The resident population and its fertility and mortality are more relevant to the particular area than those of temporary visitors. 5/ A study of events by place of occurrence would introduce the well-known anomaly caused by hospitals, maternity clinics and the custom of giving birth to a child at the home of the mother's family. 6/ A growing interest in internal migration makes it desirable to collect data on the basis of usual residence.7/ It would not be possible to collect longitudinal information on temporary visitors. It is also well known how difficult it is to record by any survey method births and deaths which occur to transients in any area.

It has, however, also been suggested that both residents and visiting non-residents be recorded, that in each case the duration and reason of presence or absence be written down and that at the time of data processing it be decided which categories should be utilized. 8/ This would inevitably complicate both the field work and the data preparation. It seems far preferable to adopt a clear definition and let the interviewer decide on each case on the spot with the evidence at hand. This does not preclude the possibility of studying non-residents in ancillary surveys carried out on separate questionnaires.

The next question obviously is: who is a usual resident? For any given geographical location (or address), a "usual resident" is one who resides at that location. 9/ Very often, a minimum time limit, such as six or three months, is applied: so that a person who has stayed in the location that length of time or longer is considered a usual resident. Exceptions, however, may be made regarding certain categories of persons, such as hospital patients, students, military personnel etc. Persons who have arrived in the area recently but with the intention to stay may also be considered residents. It is necessary to give a clear definition to the term (Cantrelle, 1974) and to instruct the field staff carefully in its use, with numerous examples. 10/

The residence principle further requires that persons who are no longer residents, should be excluded from the survey population and new residents accepted into it. As to the former group, they should be recorded as out-migrants and then not followed to their new places of residence. In medical follow-up studies, great efforts are often made to trace, if possible, every person on the panel wherever he or she goes, but in a large survey this is manifestly impossible. It is better not even to try, because a partial success would almost certainly capture an unrepresentative selection of the out-migrants and thus introduce a bias.11/ On the other hand, in-migrants will be admitted, thus compensating for the losses. If this were not done, the sample would suffer attrition, and a bias would gradually build up as the more mobile element became underrepresented. 12/ Exclusion of permanent out-

migrants and inclusion of permanent in-migrants is logical and corresponds to a common principle in population and vital statistics.

An important rule which has served well in the four surveys from which examples for this report have been drawn is that the survey record is considered authoritative until amended. This means that each person currently on the survey record (i.e., who according to records is currently a resident of a sample area) belongs to the sample -- and no one else. Omissions can be corrected at each later round, and the person in question will then be included in the sample population as of the date of correction but not retrospectively for the missed period. Erroneously included persons will be excluded from the sample when they are discovered, and they will not be included in the population denominator for the period for which statistics will next be prepared.

The survey will record the births which occur to women who are currently on record as belonging to the sample population and the deaths of persons currently on record, including deaths of newborn children of women on record. The births and deaths of in-migrants which take place in the sample area before the recording of in-migration are therefore out of scope, and a newborn child, if living at the next round, will be recorded as in-migrant together with the mother. The purpose of this rule is to exclude this segment of fertility and mortality experience altogether, because it cannot be effectively observed by the follow-up technique.

In a similar way, out-migrants are excluded from the sample population as of the date when they were last recorded as residents in the area for the reason that births and deaths in out-migrant households after that date, but before the move, cannot be securely recorded, due to lack of a follow-up interview.

The solution therefore has been to exclude from the study the open-ended periods of a migrant's stay in the area which do not fall between two actual interviews. This solution is predicated by the concern to observe only persons who have been recorded and only as far as they can be followed up, in order to avoid the omissions of vital events which have distorted or invalidated so many vital rates surveys. It is not a perfect solution since it per force excludes migrant households and their births and deaths, from the sample system at points of origin and destination during the interval between rounds in which the move takes place . If a correlation exists between migration on the one hand and fertility or mortality on the other, this naturally has an effect on the results. The occurrence of a birth or of a death may be the direct cause of a move, just as it may be a reason not to move. The cause and the effect do not necessarily follow each other in the same interval between rounds, and they both may thus be recorded, in which case the results are not affected. Since many moves in connection with vital events are temporary, much of the possible disturbance is avoided by applying a conservative residence concept, so that, for example, a woman who goes to her parents' home for childbirth is considered resident of her husband's household.

It is entirely possible, of course, to include the open-ended periods of migrants in the study. However, this theoretically more satisfactory procedure may backfire, because it is

much more difficult to obtain reliable information on vital events that occur in those fringe periods and the result is likely to be a downward bias. It is considered preferable to cut off the fringe periods in order to have more solid data and to preserve rigorous correspondence between the events and the base population.

The population in scope in a sample survey is usually further restricted for practical reasons. As is well known, in most types of household surveys institutional households are excluded, and only non-institutional households are retained. Some institutions have birth and death rates substantially higher or lower than the population at large, and some have exceptionally high or low migration rates. 13/ Sometimes, there is the problem of obtaining free access to certain institutions, while in others the information may be readily and reliably available from institutional records. 14/ In area samples for demographic surveys, however, it has not been customary explicitly to exclude non-private households, and it may be assumed that small institutions and other types of collective households have usually been absorbed in the sample. However, a large institution corresponds in size to one or more sample clusters, and in a population census it often constitutes an enumeration area by itself. Although written reports do not seem to have mentioned such cases, one may assume that if an enumeration area constituted by a prison or an asylum for the chronically ill has been selected from the frame, it will have been discarded and possibly replaced by a non-institutional areal unit. Military barracks are in a census usually special enumeration areas and may be entirely outside the sampling frame. In such excluded areas there may be houses where professional soldiers live with their families. A small proportion of the general population therefore usually remains out of scope of the survey. The same holds true for household surveys in general.

Certain other population groups may also be deliberately excluded from selection for any of a variety of reasons but most often simply because of the difficulties expected in covering them. For example, in census-taking, certain population groups in desert, jungle or mountain regions out of touch with persons outside their own village or group are often excluded or only estimated, and the same practice is followed in surveys. Furthermore, nomads have usually been considered too elusive for inclusion on a longitudinal study.

Duration

Any survey which observes current vital events or migration should have a minimum observation period of 12 months in order to eliminate the effects of seasonal variation. Many of the early follow-up surveys were indeed of that length. There are, however, advantages to extending the duration. If that is done, it is obviously best to do so in terms of additional 12-month periods. A longer duration makes it possible to observe annual variations in the vital rates or to smooth out their reflections in the estimates. It will also improve the cost-efficiency of the survey, because neither the preparatory work nor the baseline round need to be repeated. 15/ This advantage can be used for either a reduction in the sample size and cost, in which case the users have to be satisfied with average values and be willing to wait

longer for the results, 16/ or, keeping the sample size constant and accumulating more person-years of observation and more vital events, thus improving the precision of the estimates and making possible the calculation of more details. 17/ Other important considerations are that, in a longer survey, the field staff become increasingly familiar with the sample areas and the method and that the organizers can improve the instructions, training and logistics of the survey; on the other hand, with a longer duration the survey may clash with other activities.

A longer duration with a smaller sample of course means less baseline information, which may be important for certain reasons, though probably not for the first-priority objectives. A fixed sample will also introduce some covariance in observations.

It is with such considerations in mind that the four surveys here examined have been planned from the very start for a period longer than one year and it was only because of an impending population census that the surveys in Iran and the Syrian Arab Republic were limited to three years. In those two surveys, an improvement in accuracy was noted from year to year, while in Nepal there was first improvement, then deterioration. A longer duration makes it possible to raise the quality in the course of time, but no such improvement in any data collection activity should ever be expected to follow automatically.

A three-year survey may be considered long enough for estimating the levels of the indicators, but not trends in them. For the latter purpose the survey should either last 5 - 10 years or be repeated in another three-year period after a lapse of time. A proposal for a survey of one to two years' duration every five years would seem to be a pattern of too short and too frequent, in light of recent experience. 18/

It is entirely feasible to continue a demographic follow-up survey indefinitely. In such cases it would be necessary from time to time and at least after each decennial population census to update the sampling frame and accordingly to modify the sample or to select an entirely new one.

Periodicity and timing

In many of the earlier surveys the intervals between visits in follow-up surveys varied all the way from one month to one year . It is now generally considered that one year is in most circumstances too long an interval for effective observation and that more frequent visits will improve the data but that for cost considerations a compromise has to be made. Quite apart from the cost, however, it is doubtful whether monthly visits would produce the best data. The possibility that frequent visits will create respondent resistance is often mentioned and sometimes -- but not always -- found to be true. Another very likely result is that since frequent visits produce no record of change in household after household, they lead to careless interviewing and lower the sense of purpose of the staff. After years of experience, it is now thought that six-month intervals are the most practical and that three-to-four month

intervals might be necessary in urban areas, where fewer transportation problems make them easy to carry out and greater mobility of the population makes them more needed. 19/

Seasonal and financial factors, however, may sometime preclude even semi-annual visits. In the Sine-Saloum area of Senegal, the rainy season, with its demanding agricultural work, makes it difficult to engage personnel and to contact people and also hampers movements. (Good results were nevertheless claimed with annual visits.)

The introduction of built-in quality control has undoubtedly eliminated many of the reasons for very frequent visits. The application for pregnancy follow-up has moved in the same direction while, on the other hand, survey intervals longer than six months can obviously create recall problems. The surveys in Iran, Nepal, Samoa and the Syrian Arab Republic have all used or are using six-month intervals, and the experience is very positive since that periodicity has been found generally satisfactory from both the statistical and the operational points of view. A faster -- say, three or four month -- rhythm would, in principle, improve information on migrants, but not to a great extent unless short-term moves are a study objective.

There is usually no strong reason why the survey year should coincide with the calendar year. 20/ Survey organizers are justifiably more concerned with operational facility and reliability of information. The first of January and first of July are not everywhere suitable dates for survey visits, and besides, it is usually not feasible to carry out a survey round in just a few days; in many cases each round is staggered over a period of several months. 21/ A strength of the follow-up method is that it does not rely on people remembering dates; the use of a reference date different from the date of the interview would forfeit this advantage, which among many populations is decisive.

When calendar years are not followed, there is wide latitude for timing the survey rounds in the operationally optimum manner. It is advisable to avoid periods of heavy rain, floods, extreme heat or cold or deep snow if those conditions are likely to impede transportation. Major festivals and pilgrimages and periods of fasting or intense agricultural activity should also be avoided, if possible. A very rigorous periodicity is not essential because minor deviations from a 365-day cycle can be taken care of by adjusting the person-years. Even greater flexibility is possible regarding the intermediate rounds; when results are calculated for a 12-month period, it is not too serious a matter if the two half-years are actually of five and seven months. Larger deviations than that, however, may affect the collection of data and produce gaps in the recording of pregnancies.

In order to avoid periods of heavy workload, it is common in follow-up surveys to stagger each round over a period of several weeks or months, thus producing a moving reference period which is of approximately equal duration in the entire sample.

Some experiments have been made with much longer intervals by making use of existing records of past censuses or surveys and carrying out a single follow-up enquiry to

ascertain the whereabouts of the same individuals and possibly to record other information concerning them. Such surveys were conducted in Cameroon in 1967/68 and in Burkina Faso in 1972/73, both after an interval of more than 10 years, and in Samoa in 1975 after an interval of more than three years (see annex). This method of "renewed surveys", as it is called by Quesnel and Vaugelade, 22/ is inexpensive in relation to person-years-at-risk covered but tends to suffer from an appreciable number of cases for which no information is obtained. In spite of its limitations, the method would seem to deserve more attention and experimentation. Archive materials could be tested on a small scale in order to probe the feasibility of their use in renewed surveys.

The sample

Sample design

There is nearly complete unanimity among those who have worked with the follow-up method in demographic statistics on the advisability of using an area sample. The most tangible reason for using area sampling is cost-efficiency. Because current births and deaths are relatively infrequent events, a large population has to be canvassed in order to record a sufficient number of them. If the population is very scattered, the effort and cost required to cover it increase many times over. Another reason for area samples is that the household is simply a convenient step for locating individuals, not a unit of sampling or of accounting, and therefore the often difficult problems that arise in determining households are avoided. Thirdly, a geographically delineated area makes it possible to include at each round newly constructed housing and thus to measure in-migration more adequately and to maintain the representativeness of the sample. Fourthly, people generally accept more willingly an enquiry that is made in every household in the area and offer better cooperation.

Area sampling means clustering of a type that is sometimes called "compact clustering", because the primary units of enquiry -- the individuals in the sample -- are living clustered (however loosely) into given geographical areas which are exhaustively covered. "Area sample" and "compact cluster sample" are not synonymous terms; while the former is always of the latter type, the reverse is not necessarily true if the clusters are formed by drawing consecutive units from a list.

It usually happens that persons who live in the same area share common characteristics more than do persons who live farther apart. For this reason, clustered samples are subject to what is called "design effect" and which always increases the sampling error compared with a fully random sample of the same size. 23/ Such an effect may be measured by the rate of homogeneity (roh), introduced by Kish. 24/ Essentially roh measures the proportion of total variance between individuals which is attributable to variation between clusters. If within a stratum everyone in the same cluster falls in the same category on a given characteristic and if there is variability between and only between clusters, then roh = 1 for that characteristic. If the characteristic is distributed at random among clusters, then roh = 0. 25/

To estimate the effect of clustering in a given stratum, we have the equation: 26/

$$V = V_o \quad [\ 1 + (n-1)\ roh\ ] \qquad (1)$$

in which V = actual sampling variance

V_o = sampling variance for random (unclustered) sample of the same total size

n = average cluster size, persons.

The term in square brackets is called design effect (deff).

The larger the roh, the greater is the design effect and the larger the sampling error. In any given sample, roh may be quite different for different characteristics 27/ and it has been found through experience that in most populations it is relatively low regarding fertility and mortality and indeed very much lower than for many other population characteristics, particularly social, economic and employment variables. This fact strongly mitigates the adverse effect of clustering in the measurement of natality and mortality. In several African surveys and censuses, typical values of roh have been found to be about 0.002 for crude birth rate and about 0.003 for crude death rate. 28/ As to migration, roh and deff tend to be larger, possibly a great deal larger and very likely widely different in different populations.

In table 1 sampling errors of birth and death rates are given for some selected roh values, cluster sizes and overall sample sizes in a non-stratified sample. Although theoretically not exact, it is a good approximation for equating persons in a one-year study with person-years in a somewhat longer study, and the total size is therefore indicated in person-years.

It emerges from the examination of these values that when roh is small, the cluster size is a less important factor than the total sample size. Although, with constant overall size, a smaller cluster size reduces the sampling error, it also increases the number of clusters and therefore the cost and the effort. At constant total cost, a smaller cluster size may well increase the sampling error because it will require a reduction in the overall sample size.

To illustrate table 1 with an example: if the sample has a population of 50,000 and is composed of 100 clusters of about 500 persons each, and assuming a roh of 0.002, then a birth rate in the neighbourhood of 40 per 1,000 will have a sampling error of 1.3 per 1,000 population. In such a case there is a 95 per cent likelihood that the true rate is between 37.4 and 42.6, those being the 2-sigma confidence limits. When the results of two years are put together, the sampling error declines to 0.9 (the same as in a sample of 100,000) and in three years to 0.7 (as in a sample of 150,000). The combined result for three years would then have 95 per cent confidence limits of 38.6 and 41.4.

In the same sample, assuming a crude death rate of about 15 per 1,000 and a roh of 0.003, the sampling error in one year is 0.9, in two years 0.6 and in three years 0.5, in which case the 2-sigma confidence limits are 14.0 and 16.0.

It was suggested that the variability between area units to a certain degree includes variability due to enumerators. 29/ This line of thought leads to the conclusion that even a non-clustered sample will suffer from a cluster-like effect when the same person interviews a sequence of households or individuals. 30/ As a consequence, the relative disadvantages of clustering will be somewhat diminished.

Sample size

It may be useful, first of all, to recall that the accuracy of estimation from a sample depends mainly on its absolute size and very little on the fraction it represents of the relevant population. 31/

It has been shown above that a sample of about 50,000 population, even when clustered, will produce annual birth and death rates with an accuracy that can be described as satisfactory. When considering what is acceptable, it should be remembered that the underlying fertility and mortality levels themselves are subject to cyclical fluctuations and occasional jolts which will cause the annual vital rates to vary even if they are exhaustively and precisely measured. Furthermore, the persistence of non-sampling errors must be assumed even if, in a survey of the type described here, they may be limited to small proportions. Altogether, it would not be useful to try to reduce the sampling error much below the combined effect of true annual variations and non-sampling errors, unless short-term changes themselves are a study objective.

A sample of 50,000 persons will also produce, annually, adequate urban and rural vital rates, age-specific fertility rates and related derived indicators and an infant mortality rate, but the age/sex-specific death rates will apply for wide age categories only. It will also yield annual estimates of overall internal migration, net rural-to-urban migration and the age and sex composition of the migrants. Approximate values for major socio-economic, educational or other population subgroups can also be obtained annually, provided such variables can be attached to individuals or households in the sample.

However, a larger number of person-years is required for death rates by five-year age groups, for a solidly constructed life-table, for better measurement of migratory flows and for greater detail and precision in all differential fertility and mortality estimates. The same is true, in particular, for subnational estimates. It would generally be preferable, for reasons given in the section below on duration, to accumulate the required person-years through a longer survey rather than by increasing the sample size. A sample of 50,000 can be expected to produce in four years much better data than a sample of 200,000 in one year.

Table 1. Expected sampling error (1-sigma) of vital rates per 1,000 population at varying ratios of homogeneity (roh), cluster size (n) and sample size

Rate	roh	n	Total sample size (person-years) 20,000	50,000	100,000	150,000
Crude birth rate: 40 per 1,000	.000	any	1.4	0.9	0.6	0.5
	.001	300	1.6	1.0	0.7	0.6
		500	1.7	1.1	0.8	0.6
	.002	300	1.8	1.1	0.8	0.6
		500	2.0	1.2	0.9	0.7
	.003	300	1.9	1.2	0.9	0.7
		500	2.2	1.4	1.0	0.8
Crude death rate: 40 per 1,000	.000	any	0.9	0.5	0.4	0.3
	.001	300	1.0	0.6	0.4	0.4
		500	1.1	0.7	0.5	0.4
	.002	300	1.1	0.7	0.5	0.4
		500	1.2	0.8	0.5	0.4
	.003	300	1.2	0.7	0.5	0.4
		500	1.4	0.9	0.6	0.5

The main, valid justification for a substantially larger sample size would therefore be to obtain reliable data in a short period of time for subnational divisions.

Cluster size

The optimal cluster size in follow-up surveys has been widely discussed among survey statisticians, 32/ and the general consensus is that a cluster size of a few hundred persons has been the most effective. It can, however, be shown that the optimum is very broad in the sense that quite large departures from it do not involve large losses of efficiency. It is moreover not very important for the clusters to be of very closely uniform size, but opinions

vary and no guidelines have been agreed on. Excessive variation could lead to uneven workloads and might introduce bias into ratio estimates. This can be controlled by segmentation.

There are other requirements, however, and the most important of them is that each area unit (cluster) must be clearly delineated and identifiable on the spot. Secondly, because frame preparation, if started from beginning, is a very lengthy and costly task, advantage should be taken from any suitable already existing frame.

For these reasons, the latest population census has been the preferred frame in follow-up surveys, and the census enumeration area has most often been the primary sampling unit. A census covers the entire territory of the country (or all inhabited parts of it) and there are usually maps available down to the enumeration area level. These latter are usually of approximately the desired size. If, however, they are too large, there are two ways of reducing them. One method is to decide from the outset that each selected unit will be divided into a fixed number (such as two or three) of sections, of which one will be selected at equal probability. The other -- useful when the sizes of the units are known and highly variable -- consists of marking against each unit in advance how many sections it will be split into if selected; the units are then selected at probability proportional to the number of such sections, and each selected unit is then split into the indicated number of sections, of which one is selected at equal probability. In either procedure the actual splitting needs to be done only for the selected units, not for the whole universe.

The contrary problem was encountered in the rural areas of some countries where the local units were too small. Therefore, two contiguous units should be joined together to form one sample unit. 33/

An alternative frame is the administrative system of the country. It also covers the entire territory and may or may not be adequately mapped. Sometimes the smallest administrative divisions are small enough -- or even too small -- for survey purposes and have actually been used as census enumeration areas. In most countries, however, this is not the case, and considerable work would be required to divide the smallest existing subdivisions into suitable sampling units. For example, the clusters adopted in the Iranian survey were census enumeration areas; in Nepal, wards (in pairs); in the Syrian Arab Republic, census, city blocks and villages; and in Samoa, villages.

As to the average cluster size, the list below is based on a number of actual surveys.

Country	Survey year	Average cluster size (persons)
Cambodia	1958/59	290
Indonesia	1961/62	500
Morocco	1961/62	445
Nigeria	1965/66	1 766
Nigeria	1967/68	416
Algeria	1969/70	500
Honduras	1970/71	257
Senegal	1970/71	433
Burundi	1970/71	1 250
Haiti	1971-1975	878
Iran	1973-1976	603
Peru	1974-1976	152
Nepal	1974-1978	405
Panama	1975-1977	119
Syrian Arab Republic	1976-1979	692
Malaysia	1981-1983	514
Samoa	1981-1985	175

Stratification

In national vital statistics, the most important breakdowns are to major civil divisions and to urban and rural sectors. Likewise, in demographic follow-up surveys, the urban/rural dichotomy has usually been considered important, and major civil division results have also been prepared, unless they have remained out of reach because of insufficient size of the sample. In order to assure proper representation to these entities, survey planners would very likely consider in the first place stratification by urban and rural sectors, next by major civil division and perhaps by size of locality.

However, in geographical terms, the simple method of systematic sampling with random start actually produces the effect of stratification although it will not make possible the use of variable sampling fractions. Because of the likelihood of urban/rural differentials and the interest in them, in most surveys the two sectors have been treated as separate strata. When this is done and when in each of the two sectors the selection is done systematically from a geographically arranged frame, the result is a geographically balanced sample which, for this same reason, also represents the population well in many other respects -- and the better, the more units it contains. There are seldom strong reasons for additional stratification as far as vital statistics are concerned. Although it is true, as is often said, that stratification can improve the results or at any rate can do no harm, it is not advisable to go to great

lengths in search of ways to stratify a sample. According to Scott, "it is probably true to say that most samplers give exaggerated attention to stratification. It can involve complex and sophisticated procedures and this attracts statisticians hungry for a problem worthy of their skills. The gains to be made in practical terms, however, are usually modest." 34/

Sampling fractions

In vital rates, everybody carries the same weight, and when sampling is used, the most precise national results are reached by giving each person an equal chance to be selected. This means the use of a uniform sampling fraction and leads to a self-weighting sample.

If the aim is, say, to prepare equally precise estimates for each province, regardless of its population size, then the samples in all provinces should be of equal size and the sampling fractions variable. This would mean relatively greater efforts on behalf of smaller population groups and correspondingly some loss of accuracy in the composite national estimate.

Nevertheless, in many situations there are good reasons to vary sampling rates between domains (e.g., urban/rural, major regions) while keeping the sample self-weighting within each domain. The reasons become stronger as the emphasis moves from simply national level estimations to estimates for and differentials between major domains.

Perhaps, however, a greater disadvantage of varying sampling fraction would be the inconvenience in processing and analyzing data which need to be weighted. 35/ In a multiround survey which produces a large variety of data, this inconvenience tends to be substantial and to slow down the preparation of results, perhaps less through difficulties in calculation and programming than through complications in data management.

Whether stratification is used or not, the use of a uniform sampling fraction in surveys is recommended for estimating vital rates at the national level. 36/ Three out of the four follow-up surveys discussed in this report have actually used a uniform sampling fraction. The one that applied varying sampling fractions was mainly due to operational reasons (table 2).

It is certainly a good principle in statistical data collection to simplify, facilitate and support the field work by all means at one's disposal and to be willing to accept more complicated tasks in the main office. However, the sampler should constantly remain aware of what can or cannot be expected of the field and office workers actually involved in the implementation of that design. 37/ This important aspect is too often not taken seriously enough into consideration. The organizers of more than one survey have at the time of data processing and analysis found reason to regret the adoption of intricate sample designs involving complex estimation procedures. Decisions on sampling should be made with full understanding of the repercussions they will have and of the exact ways of dealing with them.

Table 2. Strata and sampling fractions in four follow-up surveys

Survey	Stratum	Sampling fraction
Iran, 1973-1976	Rural	1/300
Nepal, 1974-1978	Urban	1/25 a/
	Terai	1/329 a/
	Hills	1/169 a/
	Mountains	1/289 a/
Syrian Arab Republic, 1976-1979	Urban	1/200
	Rural	1/200
Samoa, 1981-1985	Apia town	1/10
	Villages	1/10

a/ Reciprocals of final raising factors.

Control of non-sampling errors

Non-sampling errors in sample surveys have been discussed exhaustively; many examples are given in a publication of the United Nations. 38/ Nevertheless, it is necessary to draw attention here to the particular aspects of the problem in surveys of population change and to focus on the problem of purposive wrong replies.

Non-sampling errors can be divided into three groups: coverage errors; errors due to non-response; response errors. In the follow-up method, coverage errors may arise in connection with the construction or application of an area frame, which is discussed above under "sample design" and below under "identification of sample units". 39/ Non-response is not common in vital statistics surveys, and has been quite insignificant in follow-up surveys. (It is discussed in chapter III.) The possibility of response errors requires more attention. To elicit a correct answer, the question itself has to be correctly posed, and the respondent has to understand it, know the answer and be willing to give it.

There is increasing awareness among survey takers of the possibility that the respondent may not always receive and understand the question correctly. It is the responsibility of the organizers to train and supervise the staff adequately and, of course, to provide interviewers or interpreters who have mastered a language the respondent knows. In a demographic follow-up survey, the question on birth to a named woman and the question on

survival or death of a named person are easily understood. It has to be kept in mind, however, that in some societies it is the custom to call a person by different names and for individuals to change their names. Even more care is needed in determining whether a departure is to be considered out-migration or whether an arrival implies in-migration according to the definitions in force.

It can be assumed that any sane adult or adolescent household or family member can answer the questions concerning births and deaths as presented in a follow-up survey. The same applies to migration questions, with possibly some uncertainty about the permanency of a move. Answers by neighbours and other outsiders should be considered "proxy answers" and resorted to only when a household respondent cannot be reached. In a rural setting -- less often in a city neighbourhood -- those persons usually know the vital events and moves. The question on current pregnancy should always be addressed to the woman herself; others may be able to state the fact but not the period of gestation.

Another kind of response error is the intentional wrong reply, which is understood to amount to either the withholding of information or the giving of an incorrect answer. Such an act may be perceived by the respondent as serving his interests or prestige or may simply stem from reluctance to cooperate or prolong a discussion. Although intentionally misleading answers may be more common in matters of concrete economic interest, they also occur in regard to vital events.

Whether the respondent is willing to answer correctly depends on how he perceives the enquiry: does he see it as a potential threat or a nuisance? Does he know the interviewer? Has some person of trust in the neighbourhood prepared the way? What are the neighbours doing?

The willingness of the respondents to report an event may vary depending on the nature of the event -- whether a birth, a death or a move, for instance. Assuming that fairly good cooperation is achieved, the respondent does not often decide to withhold the fact of a birth -- besides, the baby is often there to be seen. Yet, if the cooperation is not very happy, attempts at purposive omission should be reckoned with. The tendency may be strengthened by custom or superstition. On the other hand, false positive answers may occur: an adopted child may be declared as one's own, and a totally invented event may be reported.

Regarding deaths, the situation is often much more delicate. It is very widely observed that deaths in the household are quite often not willingly reported to an interviewer. 40/ This may stem from reluctance to recall a painful event; it may be a matter of courtesy not to mention a sad subject to a stranger; or there may be superstitious beliefs against it. In the forest areas of Guinea, the name of a dead person must not be pronounced, and in Congo a house where a person has died is abandoned. 41/ Similar customs are found in other parts of the world. In many parts of West Africa there is superstition against telling how many children one has or how many have died. 42/ In a retrospective survey in the Misamis Oriental province in the Philippines, purposive concealment of deaths was so extensive that

50 per cent or more of them were not revealed to the interviewer. 43/ In a multiround retrospective enquiry in Ghana, deaths were so deficiently recorded that they could not be used for analysis. 44/ Since the same reluctance or taboo naturally applies to the death of a newborn, the information on births is also adversely affected.

A few cases have come to light in which a false report of death was wilfully made. In the Iran survey, a young male respondent, when his own name came up, declared that the person was dead. (This practical joke was inevitably discovered at the following round.) In Nepal, a man declared his wife and child dead, but in response to questions about what had happened, he revealed that they had left him, to which he added that, for him, they were dead.

As to migration, the cooperation of the respondent should not in all cases be taken for granted. Urban slum-dwellers in particular have often been found keenly defensive about their situation. Fear of eviction or other undesirable consequences, on the one hand, and hope for benefits, on the other, may motivate them to conceal the presence of an occupant, to report a person who is actually not living with them or to declare a resident a visitor, or vice versa.

While there is little, if any, evidence of wilful false dating of births and deaths in surveys, the date of a move is sometimes a sensitive question to a slum-dweller or a squatter, who may simply find it prudent to state that he has occupied the premises for a long time or that he was born in the area. Sheer vanity sometime prompts a person to misstate his place of birth.

Purposively wrong replies, which sometimes very seriously affect retrospective enquiries, are relatively well controlled by the follow-up method, in which reference is always made to the earlier record or lack of it. Pregnancy follow-up provides a panel in which the possibility simply to ignore a birth or an early death is eliminated. Nevertheless, possibilities for intentional omissions and wrong answers can be found by persons who are motivated to take advantage of them. It is important therefore to be aware of such possibilities and to try to promote good cooperation with the public. This has seldom been a difficult task in a demographic survey, and the continuity of a multiround operation improves the chances of achieving it.

Questionnaire

The use of a single household questionnaire throughout at least one full year offers important advantages and is well suited for prospective questioning. The interview will be based on an existing record and previous entries can be referred to in order to clarify matters. Furthermore, editing, coding and data entry can be done on a single document. The theoretical advantages of separate questionnaires at different rounds do not materialize in practice, and great inconvenience is caused by them, both in the field and in later work. 45/

In rural Morocco in 1961-1963 identification difficulties arising from multiple questionnaires led to the rejection of many primary sampling units. 46/ In addition to increasing the field work and making editing more laborious, the use of new questionnaires for every round may alienate respondents, who will not understand the need for new listings. 47/

The basic questions necessary in a follow-up survey are very clear and ordinary and hardly require extensive pre-testing. On many of them there is ample and recent experience from a census. However, there may be unproved questions that require careful testing so that unforeseen difficulties are brought to light before they have a chance to jeopardize the success of the main survey. Among these would most likely be the question on current pregnancy, the feasibility of which may greatly vary from one country to another.

All the four surveys discussed here have used one questionnaire for each survey year. The annual questionnaire contains data relating to three rounds; the last round of one year serves as the baseline for the following year. The information on it is transcribed to new questionnaires, leaving out the persons who have been removed from the sample through death, departure or correction. The feasibility of this practice is therefore amply proved. A few of the survey questionnaires are reproduced in figures I-III.

Every one of the questionnaires has included, first of all, the geographical area and the housing address, if any, and has given the code numbers for the area unit and the household. The questions asked of each person in the surveys of Iran, Samoa and the Syrian Arab Republic are given in table 3. In several surveys on the lower part of the questionnaire there were a few blocks for pregnancy follow-up in which the following information was usually entered:

(a) Mother's line number;
(b) Gestational age when recorded (months);
(c) Outcome of pregnancy;
(d) Gestational age when ended (months).

Regarding the interview method, experience shows that demographic surveys in developing countries are best conducted by the canvasser method, in which interviewers (enumerators) visit every sample household to record the data. Interviewing by assembly or through intermediaries or by the householder method, in which the respondent fills in the forms, cannot be considered adequate.

Generally, the respondent may be the head of household or the housewife or another knowledgeable member of the household. However, questions regarding birth or pregnancy should be addressed, as far as possible, directly to the woman concerned. School-going children sometimes know their own ages and those of their smaller brothers and sisters better than their illiterate parents. A difficulty is encountered in some societies where no male interviewer or perhaps no interviewer at all is allowed to enter the house or to address the women and only the male head will give information. In case of the temporary absence of

Figure I - Pregnancy Follow-up Record, Samoa, 1981-1985

GOVERNMENT OF WESTERN SAMOA

Department of Statistics

VITAL STATISTICS SURVEY OF SAMOA 1981-85
PREGNANCY FOLLOW-UP RECORD

No. [ ][ ][ ][ ][ ] 1-5

INFORMATION ON MOTHER:

Sample Unit [ ][ ][ ] 6-8 Household No. [ ][ ][ ] 9-11 Line No. [ ][ ] 12 13

Age [ ][ ] 14 15

Name: _____

Education [ ] 16 Children born alive [ ][ ] 17 18

INFORMATION ON PREGNANCY:

Date when pregnancy recorded ___/___ 198
Months pregnant when recorded _____
Date recorded as still pregnant ___/___ 198
Date of final information ___/___ 198 [ ] 19

Outcome of pregnancy:

[ ] Live birth 1 [ ] Single 2 [ ] Twins 3 [ ] Triplets

2 [ ] Still-birth 1 [ ] Single 2 [ ] Twins 3 [ ] Triplets [ ][ ] 20 21

3 [ ] Abortion (miscarriage)

4 [ ] Moved out while pregnant

5 [ ] Mistake - was not pregnant

6 [ ] No information

Months pregnant when miscarried _____ [ ] 22

FOLLOW-UP LIVE-BORN CHILD:

Name: _____ Date of birth: _____/_____ 198___

Line No. _____ Issue [ ] Sex [ ] Date of death: _____/_____ 198___

Age at death _____ yrs. _____ mos. _____ days

Follow-up information

Round	Date	L	D	MO	?	Follow-up	Age Code Yrs.	Mos.	Days
6	/ 1984								
7	/ 1984								
8	/ 1985								
9	/ 1985								

Figure 2 - Pregnancy Follow-up Survey Questionnaire, Syrian Arab Republic, 1976-1979
(reproduced from original)

الجمهورية العربية السورية
رئاسة مجلس الوزراء
المكتب المركزي للإحصاء
مركز الدراسات والبحوث السكانية

بحث العينة الديموغرافية المستمرة
استمارة تسجيل الحمول ومتابعة نتائجها
رقم مسلسل الاستمارة

١ ٤

أ ـ بيانات عن السيدة الحامل ـ الحمل ونتائجه :

١ ـ اسم السيدة الحامل : _____ ٣ ـ تاريخ تسجيل الحمل : _____
٢ ـ رقمها بين أفراد الأسرة : _____ ٤ ـ تاريخ بدء الحمل : _____

عدد أشهر الحمل	الحالة التعليمية للسيدة	عدد الأطفال المنجبين أحياء للسيدة سابقا	عمر السيدة بالسنوات	رقم الأسرة في وحدة البحث	اسم وحدة البحث أو القرية	اسم المدينة أو القرية	محافظة	رقم الزيارة التي سجل فيها الحمل
١٩	١٨	١٦	١٤	١١	٩	٨	٦	٥

نتيجة الحمل في الزيارة الثانية					نتائج أخرى
مازالت حاملا	ولادة حية		ولادة ميتة أو إجهاض		
عدد أشهر الحمل	ذكر	انثى			
٢٠	٢٢		٢٤	٢٥	

ب ـ متابعة المولود الحي :

الزيارات	مازال يعيش في الوحدة ١	توفي ٢	غادر الوحدة ٣	غير مبين ٤	عمر الطفل بالسنة والشهر			رمز الحالة
الثانية								
الثالثة								
الرابعة								
الخامسة								
السادسة								
السابعة								
					٢٩	٢٧		٢٦

الاسم :
التوقيع :

REMINDER: Do not forget to include the names of babies and young children

Figure 111 - Demographic Sample Survey questionnaire, Malaysia (Sabah/Sarawak), 1981-1983

PSD 1

DEMOGRAPHIC SAMPLE SURVEY - SABAH/SARAWAK

LQ. No: .....

HH. No: .....

Address: .....

.....

BASIC DATA: DATE ...../..../198...													SECOND VISIT: DATE ...../..../198....							THIRD VISIT: DATE ..../..../198...							CODES					
No.	Name	Relationship to Head of Household	Sex 1-M 2-F	Date of Birth Day	M.	Yr.	Age	Marital Status	Ethnic Group	Educational Level	Usual Activity in last 12 mth.	Children Born Alive	Now Pregnant?	Status	Date of Event Day	M.	Yr.	Urban/Rural	Administrative District	State	Marital Status	Now Pregnant?	Status	Date of Event Day	M.	Yr.	Urban/Rural	Administrative District	State	Marital Status	Now Pregnant?	Status	Marital Status	FOR NEW BORN MOTHER'S DATA Age	Ethnic Group	Educational Level	Children Born
1	2	3	4	5			6	7	8	9	10	11	12	13	14			15	16	17	18	19	20	21			22	23	24	25	26	27	28	29	30	31	32
1																																					
2																																					
3																																					
4																																					
5																																					
6																																					
7																																					
8																																					
9																																					
10																																					

Pregnancies:

Line No. .....

Months pregn. when recorded .....

Outcome of Pregnancy .....

Months pregn. when ended .....

Marital Status:

1 - Never Married
2 - Married
3 - Widowed
4 - Divorced or Separated
9 - Not Stated

Ethnic Group:

01 - Malay
02 - Chinese
03 - Indian
04 - Iban
05 - Bidayuh
06 - Melanau
07 - Kadazan/Dusun/Kewijau
08 - Bajau
09 - Murut
10 - Indonesian
11 - Other Indigenous
Others
Not Stated

Educational Level:

1 - Illiterate
2 - Literate, no schooling
3 - Literate, primary
4 - Literate, secondary
5 - Literate, vocational
6 - Literate, tertiary
7 - Not Applicable
8 - Not stated

Usual Activity:

1 - Employer
2 - Employee
3 - Own-Account worker
4 - Unpaid Family worker
5 - Looking For work
6 - House work
7 - Student
8 - Others
9 - Not stated

Table 3. Contents of the household questionnaire in the follow-up surveys of Iran, Samoa, Syrian Arab Republic and Malaysia (Sabah/Sarawak)

Item	Iran a/	Syrian Arab Republic	Samoa	Malaysia (Sabah/Sarawak)
Baseline data				
Person's number	+	+	+	+
Name	+	+	+	+
Relationship to head	+	+	+	+
Sex	+	+	+	+
Date of birth or age	+	+	+	+
Marital status	+	+	+	+
Ethnic group	-	-	-	+
Educational level	-	+	+	+
Economic activity	-	-	-	+
Children born alive (for women)	+	+	+	+
Whether now pregnant (for women)	+	+	+	+
Second round				
Survey status	+	+	+	+
Date of event	+	+	+	+
Destination or origin	+	+	+	+
Marital status	+	+	+	+
Whether now pregnant	+	+	+	+
Third round				
Same as second round	+	+	+	+
Code columns b/				

Key: + asked
- not asked

a/ Several questions on the Iran questionnaire were formulated differently.

b/ On several of the questionnaires, codes are entered in special columns, on others, in answer columns.

the best informant from the premises, a call-back should be arranged, and only as a last resort should other outside informants be relied upon. When, however, an entire household has moved out, information has to be obtained from neighbours or others.

As was noted above, it is advisable to use one questionnaire for each survey year, and the questionnaire should contain data relating to more than one round of the survey. After the final round of a survey year, the data have to be transcribed on new questionnaires for use during the following year. During that process, all persons who have died or moved out will be left off the new questionnaires. For this reason it is convenient to do the transcription only after coding, in order to avoid mistakes. If there is a column for age, it will be updated. After the transcription and before the next round, the number of households and persons in each sample unit will be counted. At the same time a colour line will be drawn below the serial number of the last person in each household in order to set apart clearly any persons who will be entered later.

Field organization

The fundamental question concerning field organization is whether to engage local interviewers for the duration of a survey round or to send centrally employed staff to visit the sample areas. Although a priori the first alternative seems to offer many advantages, actual experience in follow-up surveys has been almost uniformly and even very strongly in favour of the second solution: that the survey should use outside interviewers who visit every household to record the data.

The main attribute of local persons, to be counted in their favour, is that they know the area, and to a great extent, the people themselves. This fact, which has proved a great asset, for example, in census work, may, in a survey of the type discussed here, turn into a handicap. 48/ Quite understandably, the local enumerator may be reluctant to go with a questionnaire to visit close friends and neighbours and ask whether anyone has died or moved out or had a baby, because he knows the facts and can fill in the questionnaire at home. But beyond that close circle of people, there is another which he thinks he knows but really doesn't. Further along there is yet another circle of people whom he is not very certain about at all, but he may feel that he is expected to know them and therefore is reluctant to go and question them. In matters of births, deaths and moves, a local interviewer is strongly tempted to rely on his own knowledge and perhaps on second-hand information rather than go out and ask questions. The end result has often been incomplete recording.

It has also been demonstrated that collecting information on births and deaths from a village headman or other centrally placed person who affirms he knows everybody in his village is a very uncertain proposition.

Since the survey activity in each cluster usually lasts only a few days twice a year, it is not an attractive employment offer for most local persons, and a high turnover is very

likely the result. Other problems with local personnel are that they are sometimes difficult to recruit, always more difficult to train, usually less committed to the survey and less responsive to supervision.

Centrally employed staff, on the other hand, can be offered employment for at least the duration of the multiround survey. This attracts better candidates, who can be better trained and gain more experience. Their motivation is whetted by desire to keep their jobs and to advance in their careers. Consequently, they are more amenable to discipline and supervision. In a permanent scheme it is possible to retain in service the best employees and to build up the staff to some extent through promotion from the ranks. It has been noted that supervisors who rise from the ranks because of their competence tend to be better than those who are appointed on grounds of higher education. 49/

It needs to be stressed, however, that long-term employment does not automatically lead to good performance and that an assured, permanent civil service post may even produce the opposite result. The quality of performance depends on many factors, prominent among them the intangible one of staff morale. This again is interlinked with everything that happens in the course of the survey but depends perhaps most of all on leadership which, if it is inspiring, can carry the work through hardships and adversities. A long- or medium-term campaign gives an opportunity to exercise such leadership, whereas short-term employment of dispersed local staff does not. It is true that many population censuses have been carried out remarkably well in an atmosphere of national enthusiasm but that advantage of course does not exist in a sample survey.

A reduced, long-term interviewer force has to be mobile, and this entails expense. However, if interviewers remain in place, travelling instructor-supervisors are needed instead. Travel cost and strain cannot be avoided in a widespread survey. The centralization of the staff, however, does not have to be total but may be carried only up to a subnational level.

The permanent interviewer force need not be very large. For the 100,000 population in the Iran survey, located in 165 clusters over a large territory, the baseline survey was conducted by eight teams, each composed of a team leader, two interviewers and a driver, thus making a total of 24 interviewing staff who completed the task in less than two months. 50/ In the following rounds this number was reduced to 20 or 21. The Chief of Project and three staff demographers acted as general supervisors. Beginning with the third round, an intermediary level was created by promoting four of the most capable field staff members to supervisory positions, each of them responsible for two teams. The quality control was performed by two demographers and the four field supervisors. With this disposition, each field round took about two months to complete. Between rounds, the field staff was employed at the central office in editing and coding questionnaires and performing other tasks unrelated to the survey. These periods were also used for annual leave, retraining sessions and discussion of experience for feedback.

The Nepal survey of 77,000 population in 191 sample units in 74 different locations was carried out by eight teams, each one composed of one regular staff member and a temporary interviewer. 51/ There was one four-wheel drive vehicle which was used in the Kathmandu valley only. Outside of it, the field work was no easy task. The report tells how "carrying their satchels on their backs, the questionnaires, their food and blankets, the enumerators have to walk several days through jungles and dangerous passageways, and to cross turbulent rivers on suspension ropes and bridges to reach the sample units in Chitwan, Surkhet and Ilam districts", and further, "in Jumla and Solukhumbu on the Himalayan range, the enumerators were airborne to the nearest air strip from which they can reach the sample area on foot after two or three days trekking. To reach Kailali district in the far-western Terai, the enumerators have to go by bus to the Indian border, then travel for three days by train via the Indian Terai to their destination." 52/

In the other surveys examined here, the field work has been entrusted to the regular staff of the statistical offices which in some cases has been somewhat expanded but with the likelihood that all capable interviewers will continue to be employed by the office. The survey in the Syrian Arab Republic was carried out in each mohafaza (province) by the branch office staff of the Central Bureau of Statistics. In Samoa the work is done by six permanent employees and one supervisor of the Department of Statistics in Apia.

The weaknesses of some of the early surveys, such as those in Cambodia in 1958/59 and in Indonesia in 1961/62, were compounded by the short-term recruitment of a large number of interviewers. The failure of a survey in the Dominican Republic was reported to have been largely due to the employment of a large number of temporary personnel. 53/ For the large-scale survey in Algeria in 1969-1971, 100 municipal employees were recruited; their performance was not always satisfactory. 54/ With some exceptions, such as that of Algeria, a pattern evolved in francophone Africa in which regular staff make field tours alternating with office work. 55/ In several of the countries, the national statistical offices had built up a small but permanent survey organization already in the 1950s.

Experience in Latin America speaks also for a small number of interviewers working in the longer term. For the Honduras sample of 22,500 persons, the staff was composed of only four supervisors and eight interviewers. 56/ Great efforts were reportedly often required from them to reach the destination, fording rivers, riding donkeys, eating little and badly, sleeping in precarious or abandoned places. But the conclusion was that instead of engaging a larger staff, it is preferable to create a seasoned and enthusiastic nucleus, ready to work hard, completely committed to the objectives and to meeting the requirements, and possessing an honesty worthy of confidence. In Peru the sample of 48,000 persons was covered by six supervisors and 12 interviewers, later reduced to five and 10, respectively. Replacements had to be recruited and trained for those who lost motivation and dropped out. 57/

It is recognized that interviewers who periodically return to the same areas gain an improved acceptance and confidence of the people which contributes to more accurate recording. 58/ As in so many other multiround surveys, it was noted in Côte d'Ivoire that at

repeat rounds, the interviewers came to know the areas and their inhabitants better and were also better accepted by them. 59/

The question has been raised whether interviewers might be disinclined to admit and correct their earlier mistakes whereas different interviewers might implicitly take a more critical attitude towards the existing record. During the last two years of the Iran survey, teams were rotated to different regions and the change was reported to have been successful. 60/ However, in Sine-Saloum in Senegal, the contrary was found to be true: when the same interviewer made repeat visits, he more easily found previously missed cases and missed fewer new cases than a new interviewer did. 61/ On scheduled rotation of staff, there is very limited experience in follow-up surveys to draw a conclusion.

Identification of sample units

For sure identification of the area units which compose the sample, it is important to prepare maps or sketch maps which show clearly the limits of each sample unit, together with principal landmarks and possibly -- but not necessarily -- the location of each housing unit. The most important function of the map at this point is to delineate the sample unit in question unequivocally against other inhabited areas. It therefore need not be topographically accurate regarding lands where nobody lives. When a village forms a sample unit by itself and is surrounded by fields or forest, new houses may in the course of the survey be built not only within but also outside the old perimeter; a loosely drawn boundary on a map should not in such case be considered authoritative.

It is very helpful to attach a permanent number at the entrance of each housing unit. Multiround surveys have, nevertheless, also been successfully carried out without house-numbering, because the households can usually be located and identified with the help of the names.

If a population census has been taken recently, adequate detailed maps of enumeration areas may be available. Depending on the time lapse, it may be necessary to bring such maps up to date before the survey; alternatively, supervisors may do the up-dating during the initial survey round. If no map is available, a census household list could be useful.

Too great reliance should not be placed on the ability of the personnel to read maps, and it may not always be possible to give adequate training in map-reading to the staff. Even when maps are given to interviewers, experience has proved it absolutely essential for supervisors to show to each interviewer the limits of the sample unit on the spot. It should be stressed to the interviewer that in the last instance, it is his responsibility to make sure that he covers all inhabited structures within the confines of the sample unit, irrespective of whether they appear on a map or on a list or were enumerated before.

An example of necessary geographical flexibility is reported from Iran where an earthquake had damaged a sample unit shortly before a survey round in November 1973. No lives had been lost, but several families had moved to live in tents at another location. They were all duly interviewed and by the next following round had already returned to the village and rebuilt their homes. 62/ In another case from Iran, a rural unit near the city of Mashhad had been caught up by the expanding city after the previous census which served as the frame, and the survey team was at a loss to recognize its allocated area. A staff demographer, called to the spot, identified the unit and prepared a map of its boundaries after which there were no further problems. The inhabitants, though engulfed by the city, continued to be occupied in farming. 63/

Communication with the public

No survey can be successful without the willing cooperation of the respondents. The reaction to any survey, whatever the method, may range from outright refusal through suspicious or sullen acquiescence and casual and careless tolerance to an earnest effort to cooperate. To achieve cooperation, it is useful to give the respondent population a general idea of what the survey is about and to explain the way it is carried out. It is important to lay to rest any worries about undesirable consequences which in the fertile popular imagination may range from taxation and fines to loss of housing or police intervention. On the other hand, it is wise not to dwell much on expected long-term benefits of the survey, because people have a tendency then to expect immediate and concrete ones.

Though surveys have been carried out virtually without publicity, a certain amount of public information is usually helpful. In contrast to a general census, the publicity campaign for a sample survey has to be done selectively and discreetly. From the wide choice of possible communications media, those that are best adapted to local conditions and the least expensive should be selected. The choice of the media and the themes will also depend on what kind of population should be reached and whether it has earlier experience of surveys or censuses. One census or survey may pave the way in the public mind for another one -- but may also have the opposite effect.

To gain acceptance for a survey in a community, one must adopt an approach that respect the customs and sensibilities of the community and that therefore involves certain procedures and usually takes a little time. When only a few households in a community are selected for the survey, the reason has also to be explained and, occasionally, resistance has to be overcome. It follows that surveys with compact clusters of entire villages or city neighbourhoods generally have smaller acceptance problems for the same number of households than surveys of selected households. A very common experience is that "very rarely did a household refuse to give information once the village as a whole accepted the survey". 64/

Once the approval for an enquiry is secured at a higher level on the local scene, the stamp of approval in rural areas is often given by a village headman or tribal chief or perhaps by a formal committee or an informal group of elders. 65/ In urban areas comparable leaders or bodies may exist, though less often, and their hold on the public may be more tenuous. At any rate it would be quite out of the question to begin a survey of the dimensions here envisaged without properly informing the local authorities.

The cooperation that the community is inclined to give depends to a great extent on the questions asked and on the length of the interview. Questions touching on income and wealth are among the most sensitive. In francophone Africa administrative censuses have in people's minds been associated with taxation, and this fear has made respondents reserved about any kind of enumeration; in follow-up surveys when people gradually became convinced that no harm was coming, acceptance improved, and at later visits the reception was cordial and friendly. 66/ Another popular fear which a survey may encounter in older town quarters and shantytowns is that it will be followed by demolition and forced relocation; this has led to evasive and untruthful answers. 67/ Questions intruding on privacy may also create resistance, but this fear has been much exaggerated. The large-scale World Fertility Survey is a case in point; naturally, questionnaire testing is essential. The question of whether a married woman is currently pregnant has elicited very good response in Iran and the Syrian Arab Republic. Questions which transgress the line of privacy, as conceived by the respondent, are not actually harmful if it is possible for him/her to give an evasive or negative answer. The survey takers naturally would have to understand this loophole.

In Algeria the difficulty for even female interviewers to contact the women of the household has been reported, but otherwise the survey did not meet resistance when the questionnaire was simple. 68/ It is reported from Honduras that since the questionnaire was short and simple and dealt with ordinary matters, there was no lack of cooperation. 69/

In follow-up surveys repeat visits by the same interviewers have been found to ensure full cooperation eventually even if cooperation was withheld at first. In a recurring operation the staff improve their technique and their approach to the public and increasingly gain the confidence of the respondents. 70/ In Samoa, fears of taxation were found to be lingering and creating reserve at the second round. 71/ The much-feared respondent fatigue has not developed in multiround surveys if the interviews have been short and simple and devoid of objectionable questions. 72/ Repeat visits did not create resistance in the surveys of Algeria, Iran, Nepal, the Syrian Arab Republic or Sine-Saloum, Senegal. 73/

It has also been observed that errors and failures are often due more to imperfect communication between the interviewer and the respondent than to lack of cooperation or so-called memory lapse. 74/ It is very desirable to have interviewers who can speak the local language or dialect so as to minimize the need for interpreters. 75/

Quality checks

A quality check by reinterviews is the centerpiece of the new series of demographic follow-up surveys, and it has rendered great service both in improving the recording of vital events and in measuring its completeness. The quality check device serves in this particular technique three different functions.

First, it can be expected to improve the performance of the field teams, making them more careful when they know that their work will be verified. Such improvement has been noticeable enough to have been reported as a fact. This type of check is a form of quality control. Sometimes the effect has been a delayed one, so that once an actual control round has demonstrated its effectiveness and some careless staff have been dismissed, the quality of the next round has shown improvement.

Secondly, the quality check, with subsequent matching against the regular questionnaires, provides an estimate of the completeness of the recording of vital events. This makes it possible to reject a batch of inferior material, to order the affected units to be canvassed again or to take measures to ensure careful updating of the records at the next round.

Thirdly, the quality check can and normally should be used in the evaluation procedure. The reciprocal of a completeness estimate gives a correction factor which can be directly applied either to the recorded numbers of appropriate vital events or to the corresponding rates.

Concerning formal quality control, a recent publication of the National Household Survey Capability Programme of the United Nations states that, because of the high cost and time required to conduct and process them, reinterviews cannot be recommended for quality control purposes in a one-time survey; their use in this way is generally restricted to continuous or periodic surveys. 75/

As applied in the survey example presented in chapter I, quality checks consist of reinterviews, also called "control interviews", carried out by special investigators in a subsample of households. It is desirable for the control to be carried out by staff with more experience and authority, including survey leaders who thus gain a closer view of what happens in the field. Though it can be hoped that the reinterviews would be of better quality than the regular ones, it is not essential that it be so and, in fact, if the check is done with reasonable care, it is rarely possible to improve on it. The measurement of completeness with a quality check is predicated on the principle that two independent sets of data provide a check on each other. When matched, they are considered equal in quality.

The control records are not used for actual correction of the regular questionnaires because, first, they are not necessarily more accurate and, secondly, they are extant for only a subsample of households. Since the original set covers 100 per cent of the sample, it is its

completeness which is of prime interest and it is for its results that correction factors will be calculated.

It is sufficient to carry out control interviews once a year -- namely, in connection with each round that completes a survey year (i.e., the third, fifth and seventh etc.) rounds, if the periodicity is semi-annual. For each selected household, a copy is made of the questionnaire exactly as it was filled in at the first round of the survey year. Then, soon after the last round of the survey year, control interviewers visit the subsample households and record on the questionnaire all changes that have occurred since the interview 12 months before. Care has to be taken to record the exact dates of recent events in order to account for those events that have occurred in the short period between the third round and the control. The control questionnaires are matched in the central office against the corresponding regular questionnaires, which also contain information on the intermediate rounds in the same 12-month period. In each subsequent year, the quality check is repeated in the same way -- namely, just after the round which completes a 12-month period.

The field staff is warned that a control will be made, but the details of the subsample are kept strictly secret until the regular survey round in a given region is completed. Likewise, the two sets of records are kept separate until they are matched in the central office. To avoid any mix-up, the control questionnaires are either clearly stamped to indicate what they are or printed on paper of different colour.

The size of the quality check sample should be varied according to needs. While theoretically it would be ideal to conduct a 100 per cent control, it would seem that an annual control of about 2,000 households (10,000 persons) yielding some 300-400 live births and 100 deaths would be sufficient, particularly considering that the results of subsequent years will strengthen the body of evidence available.

It would undoubtedly be desirable to increase the size of the quality check subsample in order to reduce the effect of chance. To do this would inevitably increase the cost and, what may be more serious, create management problems in the field because the control should in each area follow closely on the heels of the survey but with sufficient separation to ensure strict independence. In the survey of Iran, the quality check subsample of the first year comprised about 5 per cent of households but was then enlarged for the following years to cover every third household in every third area unit, or altogether 1/9 of all households. This larger size permitted the calculation of correction factors separately for urban and rural areas. In the survey of Nepal and the Syrian Arab Republic, the quality control subsample covered every tenth household in every area unit; in Samoa, every second household in every fifth area unit.

Operations calendar

The timetable of operations will in each case depend on national requirements and particularly on the organizational possibilities. However, it is useful to present an example, an approximate synthesis of the sequence in which the operations have been most successfully carried out in the surveys examined here. The pattern is that of two field rounds per year, each one staggered over a period of about two months in order to employ a small and mobile interviewer force of permanent or long-term employees. The example also includes one quality check operation per year and annual processing of data.

One of the first decisions to be taken is the selection of the two annual periods of field work, six months apart. This matter has been discussed above in the section on periodicity and timing. The month in which the field work of the first (baseline) round begins, corresponds to year 1, month 1 in the calendar below. (See also fig. IV.)

	Starting date		Duration
Activity	Year	Month	
First round	1	1	2 months
Manual count	1	3	2 weeks
Filling in pregnancy cards	1	4	2 weeks
Second round	1	7	2 months
Manual count	1	9	2 weeks
Updating pregnancy index	1	10	2 weeks
Third round	2	1	2 months
Quality check	2	2	2 months
Manual count (optional)	2	3	2 weeks
Coding	2	3	1 month
Matching	2	4	1 month
Transcription	2	4	1 month
Updating pregnancy index	2	5	2 weeks
Data processing (first year)	2	5	4 months
Fourth round	2	7	2 months
Report (first year)	2	8	3 months

Activity	Starting date Year	Month	Duration
Manual count	2	9	2 weeks
Updating pregnancy index	2	10	2 weeks
Fifth round	3	1	2 months
Quality check	3	2	2 months
Manual count (optional)	3	3	2 weeks
Coding	3	3	1 month
Matching	3	4	1 month
Transcription	3	4	1 month
Updating pregnancy index	3	5	2 weeks
Data processing (second year)	3	5	4 months
Sixth round	3	7	2 months
Report (second year)	3	8	3 months
Manual count	3	9	2 weeks
Updating pregnancy index	3	10	2 weeks
Seventh round	4	1	2 months
Quality check	4	2	2 months
Manual count (optional)	4	3	2 weeks
Coding	4	3	1 month
Matching	4	4	1 month
Data processing (third year and final)	4	4	6 months
Final updating of pregnancy index	4	5	2 weeks
Final report	4	7	5 months

According to this timetable the results of the first survey year will be available as computer print-outs one year and eight months after the start of the field operations. The execution of a three-year survey will take three years and 11 months from the start of the field operations until the preparation of the report. This period of course has to be preceded by a period of planning, preparation, pre-tests and training.

It will be noticed that in the timetable some operations are concurrent, since it is understood that they will be performed by different staff. For example, the quality check and matching is done by different staff than those doing coding and transcription. On the other hand, after the third, fifth and seventh rounds, the updating of the pregnancy index may have to be deferred until the coding and transcription have been completed. Matching and transcription have been timed concurrently, which requires an exchange of batches of documents between the two operations. Transcription has to be completed in time for the next round, and only after it has been completed and the pregnancy data updated can the questionnaires be given to data entry.

Costs and staff requirements

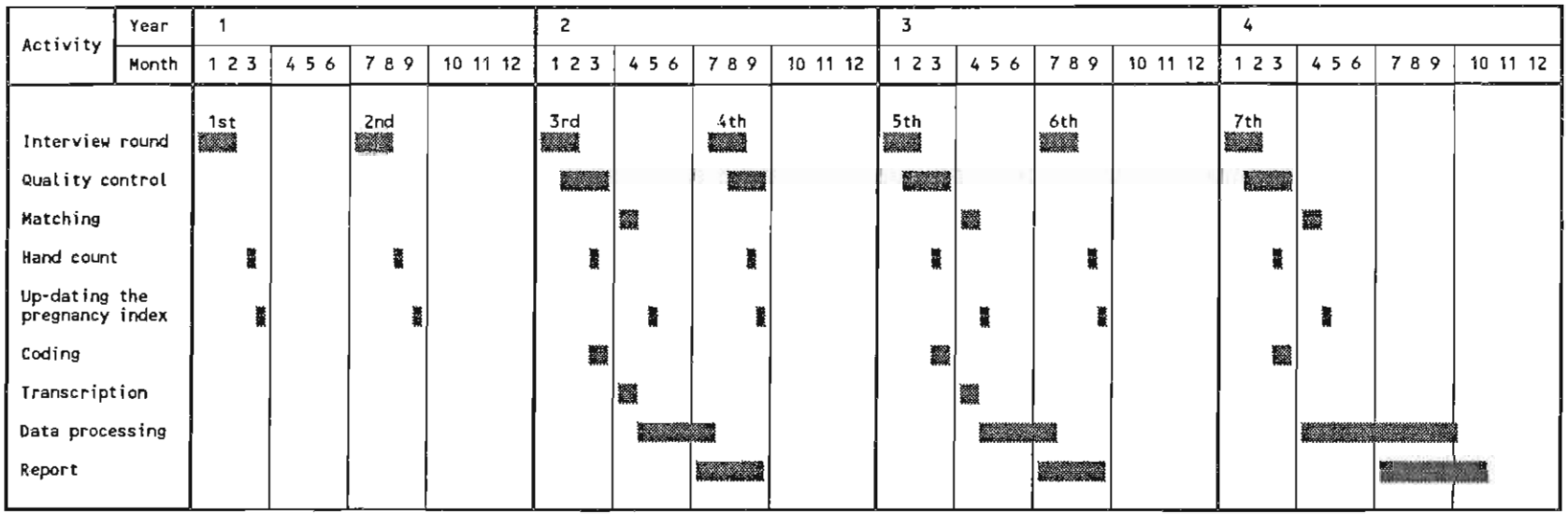
Data on costs by type of expenditure and stage of survey and data on time and staff requirements should be calculated and published. 76/ Yet, such data are hard to come by because a system of costs and staff-requirement accounting has not been well developed, and little attention has been given to the recording of such data at every stage of the survey.

For the present report it has been possible to obtain information on the cost of only three surveys -- those of Panama (1975-1977), the Syrian Arab Republic (1976-1979) and Samoa (second survey year). The information covers only some of the direct survey costs and not those borne by other government agencies and "uncosted items".

The cost in Panama was $US151,000, 77/ which in relation to the 66,236 person-years of observation gives an average cost of $2.28 per person-year-at- risk and $0.74 per person per visit.

For the Syrian Arab Republic the total budgeted cost for personnel released by the Central Bureau of Statistics was 549,000 Syrian pounds or $US137,280. This includes only the funds separately budgeted for the survey and excludes indirect and incidental costs borne by the regular budget of the Bureau, such as inputs by leading personnel, computer operations, stationery, publications and premises, which were neither separately budgeted nor estimated. If only the cost of the field personnel -- i.e., supervisors and interviewers -- was counted, the total budget was $110,280. Since the number of person-years was 126,739 and as the total number of personal situations recorded during the seven visits was about 323,000, the cost amounts to an average $0.87 per person-year-at-risk and $0.34 per recorded person per visit. Despite the fact that the payments to supervisors ($12 per day) and enumerators ($8 per day) were not low, the average cost per visit was considered by the Bureau definitely low. By extending the duration of the survey for three years, better use had been made of the fixed initial cost.

Figure IV. Operations Calendar



In the Samoan survey, the expenses during the second year (1982/83) were given as follows:

Salaries	$4,856
Travel allowances	1,527
Transportation	2,336
Printing	562
Stationery	125
Publicity and notices	125
Total	$9,531

"Salaries" above includes the salaries of the interviewer team of six persons for nine months (which cover two periods of field rounds), data transcription and manual tabulation. The total amounts to $0.27 per head of sample population and interview round and to $0.62 per person-year-at-risk. 78/ The cost of the first survey year had been of the same order of magnitude, no baseline survey having been carried out since the census records served the purpose.

Because of the large differentials in salary levels between countries and because of continuous inflation, information on budgetary cost in past surveys, in monetary terms, loses some of its usefulness to countries which are planning to undertake a survey. Furthermore, contributions made by other government agencies -- even the private sector -- to the survey are not included in the above budget costs. The problems of survey costs and methods of cost accounting are discussed in a forthcoming United Nations study on census costs and staffing requirements. 79/

Personnel needed in a survey include statisticians, field supervisors, interviewers, editors and coders, data processing staff and other office staff. Such information was also not easy to collect, and staff requirements among different surveys are difficult to compare. The discussion here therefore is centred around the requirement for interviewers.

Information on the staff requirements for seven surveys is presented in table 4. The annual duration of field work -- and thus the performance per worker-month -- are known only approximately. Not all other factors are comparable -- least of all, the physical circumstances. Nevertheless, a certain pattern emerges which may facilitate the estimation of the staff needs for a follow-up survey.

It may be estimated in a general way that after the baseline survey, which takes a little longer, one interviewer can in the follow-up rounds usually cover 2,000-2,500 persons per month. This means that a team of two can cover 8-10 sample units of 500 persons (100 households) each, or a total of 4,000-5,000 persons in one month, depending on the terrain and available transportation. This is not a hurried tempo and allows for travel time and occasional rest days, because a two-person team rarely needs more than two days in one sample unit.

If each round is carried out in two months, adding up to four months of field duty per year, then one interviewer is needed for every 4,000 or 5,000 population in the sample. A survey of the basic size of 40,000 population would thus require 8-10 interviewers. In table 4 the ratio of population per interviewer varied between 4,000 and 5,000. It should be borne in mind that a few of the surveys also included ancillary enquiries at given rounds.

Table 4. Performance of field interviewers in five follow-up surveys

Survey	Number of interviewers	Vehicles with driver	Average survey population	Interviewed population per person-month	Population per interviewers	Field work, months per year
Iran 1973-1976	20	8	99 490	2 500	4 975	4
Nepal 1974-1978	16	1	77 405	2 400	4 838	4
Syrian Arab Republic 1976-1979	35	..	46 010	1 300	1 315	2
Honduras 1970-1972	8	2	33 512	1 400	4 189	6
Samoa 1981-1983	6	1	16 291	1 800	2 715	3
Peru 1974-1976	10	..	47 944	..	4 794	..
Senegal 1970-1971	30	..	120 000	..	4 000	..

Also on the basis of past survey experiences, the estimated overall staff requirements for a survey of 40,000 population with two rounds per year is given in table 5. In addition to the types of personnel given, there is also need for the services of a typist and others, but not on an exclusive basis. As can be seen, the number of staff involved in the survey does not need to be large, and none of them is required full time around the year. The leading staff of the survey will have time for other work too, but the duties of the survey must have precedence when required. The time of the field supervisors is calculated as one month of

training and feedback, 3-4 months of field supervision, 1-2 months of control interviews. The time of the interviewers includes one month of training and feedback, four months of field interviews and four months of coding, transcription and other clerical work. The statistician and his assistant will follow field work closely and perform control interviews. The needs in data processing staff have not been estimated. As a rough guide for estimating them, the annual volume may reach 50,000 individuals, 1.5 million bytes and 10-15 tabulations. The baseline survey takes longer than the follow-up rounds, particularly if it includes a retrospective questionnaire. Ancillary surveys will naturally increase both the interview time and the processing cost and may in some cases require specially trained interviewers.

Table 5. Estimated staff requirements for a survey of 40,000 population with two rounds per year

Number of staff	Position	Worker-months per person per year	Total worker-months per year
1	Demographic statistician	8	8
1	Assistant statistician	8	8
1	Survey officer (logistics)	6	6
2	Field supervisor	6	12
2	Control interviewer	2	4
8-10	Interviewer	9	72-90
2-5	Driver and vehicle	4	8-20
17-22	Field and office staff		118-148
..	Data processing staff		..

That the survey can be conducted without employing anyone continuously for 12 months a year makes it particularly suitable to be fitted into the work programme of a permanent office, such as a national statistical bureau. It may be considered an advantage for the staff to have experience in other work as well; in fact, in many countries it would not be possible to assign a competent demographic statistician exclusively to one survey for the period of several years. Supervisors and interviewers are often happy to do field work, particularly if they receive extra remuneration for it, but nobody can be expected to tour the field continuously year in, year out. A demographic follow-up survey therefore in principle fits well, for example, into a national household survey programme.

Notes

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Chapter III

DATA RECORDING, PROCESSING AND ESTIMATION

General processing considerations

General plan

This chapter deals with the treatment of the data collected in a basic example of demographic follow-up survey as described in chapter I. It therefore does not address the data processing needs of possible ancillary enquiries or the situations which arise from coordination with general household survey programmes, which are discussed in chapter V. The procedures here described lead to estimates of fertility, mortality and migration during the survey period in the population represented by the sample.

It is customary to process and publish current vital statistics once a year, for each calendar year. Certain summary and provisional data may be derived and released more frequently, but all the main tabulations are done in relation to a full year. In addition to the practical advantages in following a routine annual cycle in the data collection, data preparation and processing activities, annual results are free from the distortions of seasonal variation and substantial enough for many kinds of cross-tabulations. However, seasonal variations in vital rates may also be a subject for investigation in the follow-up survey. Therefore, provisional results on some of the survey items may be needed.

The coding and processing plan presented in this report and used in the surveys described here, treats the stock and flow data -- the base population and the vital events -- in one single process. There is therefore no particular reason to process the baseline data separately unless another enquiry has been attached to it. If that is not the case, the main immediate interest is to know how well the sample population represents the universe. But since it is too late to do anything about it, it can await the full processing at the end of the first survey year. It is therefore recommended that the full data of the survey be processed annually -- namely, in relation to each 12-month period which does not need to coincide with a calendar year. For administrative and control purposes, however, it is virtually indispensable to carry out, in addition, a few manual counts, as described below.

Provisional results

After the initial (first round) data have been collected and examined, a quick manual count of the following for each sample unit is advisable:

(a) Number of households;
(b) Number of population;
(c) Number of recorded pregnancies.

The first two items are needed for the management of the operations. The population size will in addition be needed for the calculation of some simple early indicators of how the survey is proceeding and it should also be compared with earlier available population data, if any, unit by unit or by expanding the sample populations by the reciprocals of the sampling fractions. Recent changes in population size or maybe major coverage errors might be spotted in this way. The recorded pregnancies can be related to the population in each unit to give a rough measure of how successful their recording has been. If the number of women recorded pregnant at any given time equals half or more of the expected number of annual births, pregnancy recording may be considered reasonably complete.

After each intermediary (second, fourth, sixth etc.) round, it will be useful to count manually at least the following items:

(a) Number of live births;
(b) Number of deaths;
(c) Number of recorded pregnancies.

The births and deaths in the six-month period cannot be used for reliable estimation of vital rates but, related to the baseline population, they provide a rough and ready measure of the quality of the recording. This might reveal suspiciously low levels of data capture in some units or by some interviewers and thus allow remedial action to be taken in the form of retraining and tighter supervision for the next round. However, if recorded accurately, the data may show patterns of seasonal variations in vital events.

It might be worthwhile to expand the hand-count of the intermediary round so as to count the numbers of persons for each vital event and not only births and deaths. This might show unusually high or low levels of migration or unusually numerous corrections in some sample units -- matters that could then be looked into.

In order to be able always to distinguish between entries made at the different rounds, in many of the surveys it is the practice to draw a line in coloured pencil under the serial number of the last person in each household -- for example, a red line after the initial entries and a blue line after the intermediate round. It will then always be known when each person is entered on the questionnaire. There should be no uncertainty, if the entries are correctly made, regarding other information.

Final results

It is advisable to use a single household questionnaire for one year; if this advice is followed, the data processing is done from the same questionnaire. For that purpose space is provided in it for codes. Adequate processing requires several cross-tabulations, involving, among others, quinquennial age distributions. Processing by computer is therefore generally indicated. However, manual tabulation should also be considered because it entails almost no visible cost. Although, schematically thinking, the field staff should be in the field and the

processing staff should do the processing, there is no sense in having an interview staff tour the field for anywhere near 12 months a year. To retain capable staff -- or almost any staff -- it is necessary to intersperse field duty with periods at the home base, This raises the question of what the staff will then do. The coding and transcription of questionnaires will not take very long. The office may have other suitable work to be done, but if that is not the case and if there are bottlenecks in the data processing services, it may make sense to organize manual tabulation. In addition to solving the immediate work problems, the participation of the interviewers in more stages of the survey work will give them a better understanding of both the aims and the procedures. This tends to increase motivation and lead to useful feedback and suggestions. The dilemma of rapid turnover of trained staff, so keenly felt in many statistical offices, can be eased to some extent if there is scope for promotion from the ranks through proved performance.

If the follow-up survey forms a part of a general survey programme, both the requirements and the possibilities are thereby widened, and they may affect the optimal deployment schedule of the staff. When, as a result, more data need to be processed, hand tabulation becomes an increasingly unsatisfactory solution.

Survey status classifications

Classification and codes

In the example here discussed, the population stocks and flows are processed in a single operation. A coding system has been developed for processing the survey data. A two-digit numerical code -- called a survey status code -- is attached to each individual in the sample at the end of the survey year (table 6). This code takes into account all events, combinations of events, absence of events and corrections which may have been recorded in relation to the individual during the survey year and which are relevant for the calculation of the results. The code will also be used to give each individual his appropriate weight in the numerators and denominators of the rates which will be calculated.

Another set of letter symbols was also developed to note on the questionnaire the situation of each person at each round, as follows:

L	Living in the sample unit
D	Died
NBL	Newborn who is still living
NBD	Newborn who has died
MO	Moved out of the sample unit
MI	Moved into the sample unit
A	Added to sample because previously omitted by error
E	Excluded from sample because listed by mistake
U	No information obtained

Table 6. Survey status classification

Code	Classification	In sample at		Remarks
		Start of year	End of year	
10	Living in sample unit	Yes	Yes	Resident of sampling unit throughout the year
20	Died	Yes	No	
30	Live-born, living	No	Yes	
40	Live-born, died	No	No	
50-59	Live-born, moved out	No	No	Recorded born at 2nd round, moved out by 3rd round
60-69	Moved out	Yes	No	
70-79	Moved in, living	No	Yes	
80-89	Moved in, died	No	No	Recorded moved in at 2nd round, dead by 3rd round
90	Added to sample	No	Yes	Omitted at 1st and possibly at 2nd round by mistake
98	Removed from sample	Yes	No	Recorded at 1st and possibly at 2nd round by mistake
99	No information	Yes	Yes	No information since first round

Based on the letter symbols given at the two follow-up visits and other evidence on the questionnaire, one of the survey status codes in table 6 is given at the end of the survey year to each person on the questionnaire. This classification, with the corresponding codes, has been applied virtually without variation in the surveys in Iran, Nepal, Samoa and the Syrian Arab Republic.

The codes beginning with numbers 5, 6 7 and 8 denote arrivals in and departures from the sample unit. The second digit in these codes can be used for indication of the destination or origin of the move: code 0 might indicate a move to or from sample but within the same locality and thus not to be included in migration, while codes 1-8 could indicate region, urban/rural sector, foreign countries etc., and code 9, unknown destination or origin.

Changes of residence within the borders of the same sample unit need not have any statistical application, although they should be entered on questionnaires. If a household moves to another place within the unit, it is sufficient to change the address on the questionnaire. If a person moves from one household to another (e.g., through marriage or when a household breaks up), it is sufficient to write "Transferred to questionnaire No. A" or "Transferred from questionnaire No. C". In such a case, the person's old line should receive no survey status code at all, while the new entry should have status code 10 -- unless another event has been recorded for him.

A third digit to the code may of course be added in order to tabulate the destinations and origins in greater detail but whether this is useful depends on the size of the sample, which usually sets rather narrow limits to the possibilities in meaningful geographical differentiation.

Code 40 covers the live births followed by death within the same survey year. This combination of events may have been recorded either at the second or third round, or the birth may have been recorded at second and the death at third round.

There are two other combination codes -- namely, a birth followed by departure (codes 50-59) and an arrival followed by death (codes 80-89). In these cases, the first event is always recorded at the second round, the other event at the third round. If the two events occurred in the same interval, they would not be recorded at all. If a child is born to a woman in the sample, the child should never be recorded as moved out if the mother stays on; if both mother and child move out permanently before the next round, a question arises as to whether the birth should be recorded. The answer has been not to do so because in many -- perhaps, most -- cases the birth would not be known at all and the result would be an omission. Therefore departing persons are excluded from the sample as of the round when they were last recorded as residents.

Certain other logically possible combinations of events have not been given separate status classification. A person who was recorded as having departed at the second round and returned at the third round was considered not having changed his residence permanently and was classified as living in sample unit (code 10). A person who had arrived and departed again during the survey year was considered to have never established residence in the sample unit and was therefore not included in the sample at all. The rare case of a person who was omitted by mistake at the first round, was added to the roster at the second round and died before the third round was classified simply as death (code 20), although he was not actually under sample control during the first half-year.

It can be seen from what is said above that if a person makes two contrary moves (in-and-out or out-and-in) during the same survey year, the moves are not considered permanent, and they cancel each other out. A person can, however, make similar contrary moves by the third and the fourth round, and in that case it is not possible to cancel them out because the data are processed after the third round without waiting for the fourth. If, however, he repeats the same cycle year after year, he will never again be classified as migrant. For the sake of consistency, it is better to try to avoid recording seasonal and other short-term moves at all except in possible ancillary enquiries.

Code 90 (added to sample) is given to persons who actually were residents at the beginning of the survey year but were not so recorded. They enter the sample when they are recorded, either at the intermediate or final round of the year.

Code 98 (removed from sample) is given to persons who are found to have been erroneously included in the records. They are excluded from any rate calculations.

Status code 99 (no information) has been used only when no information have been obtained at either of the follow-up rounds. If there was any information relating to either visit, the applicable code is used. A person with code 99 is excluded from all rates for that year but usually kept on record for the following year, in the expectation that his situation can then be clarified.

From table 6, live births can be obtained from codes 30 (live-born, living), 40 (live-born, died) and 50-59 (live-born, moved out) and deaths can be estimated from codes 20 (died), 40 (live-born, died) and 80-89 (moved in, died). Out-migrants can be found from codes 50-59 (live-born, moved out) and 60-69 (moved out) and in-migrants from codes 70-79 (moved in) and 80-89 (moved in, died).

The cases of mobility within the same locality but out from, or in to, the sample can be separated from actual out- and in-migration through the use of the second digit. This may be 0 for intra-locality moves, in which case codes 1-8 would indicate interlocality migration, and code 9, unknown destination or origin. Codes 1-8 can be used for differentiation of urban and rural areas or major regions and foreign countries. The recorded events may be adjusted for underrecording by means of correction. However, their application to migration data raises many questions and is not advisable without great caution.

Table 7 provides a guide for survey status coding which has been used in several surveys. The codes were derived from survey status at successive rounds of the survey. In table 8, the results of actual practice in survey status classification for Iran, Nepal, Samoa and the Syrian Arab Republic are given.

The most frequent changes in these four populations have been caused by migration. The stability of the sample from one year to another therefore depends mostly on the level of migration. In Iran, Nepal and the Syrian Arab Republic, the carry-over of persons from one

Table 7. Guide to survey status coding [a/]

Survey status			Code
1st round	2nd round	3rd round	
Living in unit	Living in unit	Living in unit	10
"	"	Dead	20
"	"	Moved out	60-69
"	"	No information	10
"	"	To be removed	98
"	Dead	-	20
"	Moved out	-	60-69
"	"	Moved in	10
"	To be removed	-	98
"	No information	Living in unit	10
"	"	Dead	20
"	"	Moved out	60-69
"	"	No information	99
Not recorded	Born and living	Living in unit	30
"	"	Dead	40
"	"	Moved out	50-59
"	"	No information	30
"	Born and died	-	40
"	Moved in	Living in unit	70-79
"	"	Dead	80-89
"	"	Moved out	nil
"	"	No information	70-79
"	To be added	Living in unit	90
"	"	Dead	20
"	"	Moved out	nil
"	"	No information	nil
Not recorded	Not recorded	Born and living	30
"	"	Born and died	40
"	"	Moved in	70-79
"	"	To be added	90

a/ This guide was used in the survey of Iran, 1973-1976.

Table 8. Annual changes in the sample in four surveys

Situation change during the year	Status code	Number of persons				Number per 1,000 at beginning of year			
		Iran	Syrian Arab Rep.	Nepal a/	Samoa	Iran	Syrian Arab Rep.	Nepal a/	Samoa
In sample at beginning of year		308 202	131 756	21 782	32 817	1 000.0	1 000.0	1 000.0	1 000.0
Stayed all year	10	279 555	118 612	20 311	27 108	907.1	900.2	932.5	826.0
Left b/		28 647	13 144	1 471	5 709	92.9	99.8	67.5	174.0
Died	20	2 155	763	244	207	7.0	5.8	11.2	6.3
Moved out	60-69	25 284	12 359	1 168	5 367	82.0	93.8	53.6	163.6
Were removed from sample	98	1 155	..	19	129	3.7	..	0.9	3.9
No information	99	53	22	40	6	0.2	0.2	1.8	0.2
Entered and left		1 084	396	74	71	3.5	3.0	3.4	2.2
Were born and died	40	781	223	56	11	2.5	1.7	2.6	0.4
Were born and moved out	50-59	298	160	15	56	1.0	1.2	0.7	1.7
Moved in and died	80-89	5	13	3	4	0.0	0.1	0.1	0.1
Entered		35 951	13 705	1 024	5 881	116.6	104.0	47.0	179.2
Were born	30	10 116	4 918	491	812	32.8	37.3	22.5	24.7
Moved in	70-79	16 578	8 787	533	3 948	53.8	66.7	24.5	120.3
Were added to sample	90	9 257	..	..	1 121	30.0	..	..	34.2
Net increase c/		7 304	561	- 447	172	23.7	4.2	- 20.5	5.2

a/ Control subsample only.
b/ The number of those in sample at beginning of year minus those who stayed all year.
c/ The number of those who entered minus those who left.

year to the next exceeded 90 per cent; in Samoa it was only 83 per cent. The Samoan population is lately characterized as a very mobile one, but the use of a de facto census as baseline has inflated the phenomenon.

Occurrence of certain special events

Certain events occurred in subsequent rounds of a survey are likely to affect the quality of the survey more than other events. These include, for example, live births followed by deaths, live births followed by departures and arrivals followed by deaths. These events are discussed below.

Live birth followed by death

These are the most important combined vital events. When the number of such cases, occurring within a year, is related to all live births in the same period, the ensuing rate represents a certain fraction of the infant mortality rate. In conventional vital statistics, which deal with calendar years, the relation of this fraction to the entire infant mortality rate is called the separation factor. In countries of high infant mortality, the separation factor tends to be relatively low, about 0.65-0.70, while in the countries of lowest infant mortality, it may exceed 0.90, since the remaining low risk is very highly concentrated into earliest infancy. This correlation, which has been considered generally valid, is now less so, since some low-risk countries have been increasingly successful in reducing the neonatal mortality.

In a follow-up survey comprising two rounds per year, the birth and death of a child may be reported at either one of the two rounds, or the birth may be reported at the intermediate round and the death at the final round of the survey year. The separation factors may be calculated from the number of children who were born and died during the survey year (code 40), the number of live births (sum of codes 30, 40 and 50-59) and the estimated infant mortality rate (see chap. IV). Table 9 gives the results of calculation of the separation factors for Iran, Nepal, Samoa and the Syrian Arab Republic.

The factor appears somewhat low for Iran (0.62), and the likely reason is to be found in the omission of many early deaths for which a correction was made in the final infant mortality rate. The separation factor is very low for Samoa (0.38), but it is subject to a large sampling error. The separation factor for the Syrian Arab Republic (0.78) appears plausible or perhaps a little lower than expected in a country of moderate infant mortality. The separation factor for Nepal (0.81) has to be considered somewhat high for a total rate of 123 per 1,000 and might indicate an underestimation of the latter, but being limited to the 10 per cent subsample, it is subject to a considerable sampling error.

Live birth followed by departure

From codes 50-59, departures of live-born can be estimated (table 10). This combination is recorded only when the birth is reported at the intermediate round and the departure at the final round of the year. If both events are reported at the same time, the child will not be recorded at all.

Table 9. Separation factor of infant mortality derived from four follow-up surveys

Item	Iran	Syrian Arab Republic	Nepal	Samoa
1. Recorded live births (codes 30, 40, 50-59)	11 195	5 301	562	879
2. Deaths in the year of birth (code 40)	781	223	56	11
3. Deaths per 1,000 live births (2) ÷ (1)	69.8	42.1	99.6	12.5
4. Infant mortality rate, final estimate	112	53.8	123	33.0
5. Separation factor = (3) ÷ (4)	0.62	0.78	0.81	0.38

Table 10. Out-migration of the newborn derived from four follow-up surveys

Item	Iran	Syrian Arab Republic	Nepal	Samoa
Total live births	11 195	5 301	562	879
of which number that died the same year	781	223	56	11
Surviving live births	10 414	5 078	506	868
Corresponding person-years	5 207	2 539	253	434
Departures of live-born (codes 50-59)	298	160	15	56
Departure rate of live-born per 1,000	57.2	63.0	59.3	129.0
Departure rate among general population per 1,000	82.0	93.8	53.6	168.8

In Iran, Samoa and the Syrian Arab Republic the out-migration rate among newborn children -- usually connected with that of the mother, if not of the entire household -- was lower than that among the general population in the sample. In Iran and the Syrian Arab Republic, which display larger and more stable data for a three-year period, the out-migration rate of the newborn was about two thirds of the general rate. In Samoa the difference was a little smaller, while in Nepal, considering the sampling error, the two rates were essentially equal.

Arrival followed by death

Deaths among in-migrants can be examined from codes 80-89 (table 11).

Table 11. Deaths among in-migrants derived from four follow-up surveys

Item	Iran	Syrian Arab Republic	Nepal	Samoa
Total in-migrants	16 583	8 800	536	3 952
Corresponding person-years a/	4 146	2 200	134	988
Deaths among in-migrants (codes 80-80)	5	13	3	4
Death rate of in-migrants per 1,000	1.2	5.9	22.4	4.0
Death rate among entire sample population per 1,000	11.5	8.2	19.6	7.4

a/ For calculation of person-years-at-risk, see paragraphs below.

Again, for a person to be recorded at all, his arrival has to be observed at the intermediate round and his death at the final round. The figures in table 11 are too small to constitute a proof, but they convey the suggestion that recent immigrants are subject to a lower than average mortality, a suggestion which is entirely plausible.

Person-years at risk

In conventional vital statistics the mean population is used as the denominator of vital rates. This may be either the mid-year population or, preferably, the arithmetic mean of the beginning-of-the-year and end-of-the-year populations. Taking this latter case, a person who either was born or died during the year has the weight of half a person in the denominator; a child who was born and died during the year has no weight at all. In-migrants and out-migrants have the weight of half a person. Those who moved out and in again have full weight, while those who moved in and out have no weight in the denominator.

The same principle can appropriately be used in a survey of current vital rates, but the follow-up approach introduces a difference. In follow-up, the migrants are not effectively under observation during the open-end period of their stay in the sample area. In order to comply with the strict rules of follow-up observation, in the open periods before persons are recorded for the first time and after they are recorded for the last time as residents, they do not belong to the sample. The births and deaths which may occur to them at these fringe periods are not "in scope". When a person is not there anymore, it is important to find out whether he died or moved away, and this is not always easy to do if the entire household has moved. In such a case, a death may erroneously be recorded as out-migration. Although, in theory, out-migrants have been "observed" to be alive until their actual departure, in fact this is not always very sure, and there is justification for using the same population denominator for deaths as for births.

In compliance with the rule of follow-up observation, persons who moved in before the second round were under observation from that round on -- i.e., for a half year -- but those who moved in after the second round and were thus recorded only at the third round were not under observation at all. On the average, in-migrants were therefore under observation for one quarter year. The same applies to persons who were added to the sample and, in reverse, to persons who moved out of the sample. All migrants have therefore one quarter weight in the denominators. To calculate the population at risk, the different status codes have the following weights:

Code	Status	Weight
10	Living in sample unit	1
20	Died	0.5
30	Live-born, living	0.5
60-69	Moved out	0.25
70-79	Moved in	0.25
90	Added to sample	0.25

It will still be necessary to consider the length of the observation period, since it may deviate from an exact year. If such a deviation is more than just a few days, an adjustment for the fact should be made. A convenient way of adjusting is to multiply the observed population at risk by a factor which indicates the length of the observation period (survey year) expressed in terms of years. The result is person-years at risk, which can be used as denominator of rates, and there is no need to adjust the number of events.

It can be considered sufficiently precise to note the day when the first and third rounds of the survey year were started in each sample unit and to calculate from those the average observation period in days and then to divide it by 365. For example, if the average interval between the first and third rounds is 372 days, then:

$$372/365 = 1.0192$$

is the factor by which the population at risk shall be converted into person-years at risk. This was the factor used for the 1981/82 survey in urban Apia of Samoa. The average internal in

the 1975/76 survey in rural Iran was 319 days, and the factor calculated was 0.874. Person-years at risk will be calculated for all age groups of both sexes and for all other categories for which rates are wanted.

The same person-years at risk should apply to birth, death and migration rates. However, it is clear that while the restrictive follow-up rule cuts off the observation of births and deaths in the open end (fringe) periods of migration, as described above, it does not in any way cut off the observation and recording of the moves themselves. It follows that in the denominators of migration rates, departures and arrivals should have a weight of half a year instead of a quarter year. The difference is usually not large and may be of no importance in view of the inherent imprecision in the measurement of migration, but if the migration is very strong, it may result in significantly exaggerating the rate.

In some surveys the person-years at risk have been calculated individually on the basis of the reported dates of events and have been expressed in one-thousandths of a year for each individual. 1/ It can be questioned whether this laborious procedure achieves its aim of improved accuracy, particularly when people cannot remember past dates very well.

Corrections and quality checks

Corrections of earlier information

At successive rounds, earlier information may be corrected at the discretion of the interviewer according to the quality control procedure, which may require him to confer with the team leader or field supervisor in certain cases. There may be corrections of a non-statistical nature like those concerning name or relationship, or of a statistical nature such as the correction of age or, occasionally, the sex of a child. The next annual statistics will automatically reflect the corrected information.

There may, however, be two kinds of corrections which require separate treatment in the calculation of results -- namely, when a person is added to the sample after having been omitted earlier by error or oversight and when a person is removed from the sample because the interviewer is satisfied that he was never a usual resident of the sample unit. These cases reflect the fact that it is not always easy to determine the usual residence of a person. 2/ In the surveys of Iran and Samoa, large numbers of persons were added to the sample at the first follow-up rounds (table 12). For Iran it was reported that the initial enumeration had been done without sufficient care and that accuracy improved when some interviewers were released from service and others became increasingly aware of the operational controls. 3/ In Samoa a large dislocation was caused at the second round by a switch from de facto baseline census to de jure concept in the survey. The small numbers of persons removed from the sample after having been mistakenly included suggests they were temporary visitors, because in Samoa there was a relatively strong concentration of population in ages 5-34. Conversely, a tendency to consider some actual residents as temporary visitors has also been observed in other surveys. 4/

Table 12. Persons added to and removed from sample in the surveys of Iran and Samoa

Country and year		Added to sample		Removed from sample	
		Number	Percentage	Number	Percentage
Iran	1973/74	5 966	5.2	431	0.4
	1974/75	2 322	1.9	431	0.4
	1975/76	1 459	1.2	293	0.2
	Total	9 257	2.7	1 155	0.3
Samoa	1981-1983	1 121	3.4	129	0.4

Quality checks through matching

The other type of control for survey quality is a subsample check with specially designed questionnaires, or a control questionnaire. Such control questionnaires are matched in the office against corresponding questionnaires filled by the regular interviewers. The actual procedure is one of perusing the matched questionnaires and making entries in a matching list (there being one list for live births, one for deaths and, if wanted, one for out-migrants and one for in-migrants) of each event recorded on either one or both of the questionnaires. The entries should include all relevant information, or the absence of it, found on the two questionnaires. There should be space to note the decision on whether the case is to be considered an event in scope and whether it has been recorded by the interviewer or the controller or both. Children who have been born and have died during the survey year are entered on the matching lists of both births and deaths.

In contrast with the difficulties encountered in dual source systems in which matching is done between vital events emanating from two different sources, the matching of two follow-up questionnaires which have the same baseline information should present very few problems. For example, it is reported from the Iranian survey that there was no single case in which the identity of the person was in serious doubt among all the 913 matched and 155 non-matched births or the 220 matched and 61 non-matched deaths. 5/ In the surveys of Nepal, Samoa and the Syrian Arab Republic, no cases of doubtful identity were reported either. Some discrepancies in dates, however, have been reported in various surveys.

When either source, interviewer or controller, reports a birth or death which the other source does not mention, it is assumed in matching that the event has indeed taken place. This is in conformity with the general thinking, cemented into practice by survey statisticians, that in current case-by-case recording, a birth or death may be recorded or omitted but not invented. Unintentional false reports of deaths, although evidently rare, may occur, for example, when non-relatives are questioned about emigrants or absent persons, even though in

such situations omissions are more likely to occur than false report of events. 6/ Errors may also take place in distinguishing between late foetal deaths and neo-natal deaths; it is generally believed that most such errors are biased towards foetal deaths and therefore if, in a doubtful case, it is ruled that the child died after birth, it is likely that the record thereby will be set straight.

Doubtful cases can often be clarified by reconciliation visits, but such visits are costly and may delay the processing more than they are worth. Therefore, the rule that a birth or death reported by field staff will be accepted as a fact, unless there is some evidence to show that the report was a mistake, is no doubt one which helps bring the estimate closer to the true value.

The matching experience of births and deaths in Iran, Nepal, Samoa and the Syrian Arab Republic for which data are available is summarized in table 13.

Table 13. Overall results of the matching of births and deaths in quality check subsamples in Iran, Nepal, Syrian Arab Republic and Samoa

Country and year	Reported by interview	Births reported by control			Deaths reported by control		
		Yes	No	Total	Yes	No	Total
Iran	Yes	913	96	1 009	220	37	257
1973-1976	No	53	6	59	21	3	24
	Total	966	102	1 068	241	40	281
Nepal	Yes	567	180	747	215	85	300
1974-1978	No	152	--	152	51	--	51
	Total	719	180	899	266	85	351
Syrian Arab Rep.	Yes	333	2	335	74	--	74
1976-1979	No	8	--	8	3	--	3
	Total	341	2	343	77	--	77
Samoa	Yes	28	5	33	11	1	12
1981/82	No	3	--	3	--	--	--
	Total	31	5	36	11	1	12

Correction of mismatching

The following four categories may result from the matching:

a = reported by both sources
b = reported by survey alone
c = reported by control alone
d = estimated cases missed by both sources

According to Chandrasekaran/Deming formula: 7/

$$d = \frac{b \times c}{a}$$

The completeness (percentage) of the survey data is then:

$$100\,k = 100 \quad \frac{a + b}{a + b + c + d} \qquad (2)$$

and the correction factor applicable to survey data:

$$f = \frac{a + b + c + d}{a + b} = \frac{1}{k} \qquad (3)$$

If it is decided not to apply the Chandrasekaran/Deming formula, then d will be dropped from equations (2) and (3).

Ever since the Chandrasekaran/Deming formula was presented, it has been the subject of a lively exchange of experience and opinions, too extensive to review here. Blacker, in his critique of the dual source surveys, points out that "whether or not a birth or a death is reported in a demographic enquiry has nothing whatever to do with random chance" [his italics] and therefore "statistical-type corrections based on chance probability distributions ... are entirely irrelevant". 8/ The conclusion, of course, is that the Chandrasekaran/Deming correction is too small. On the other hand, false non-matches and inclusion of out-of-scope events have often exerted on upward bias in vital rate estimates, which has more than offset the shortfall and this has led -- for example -- the National Sample Survey of India to accept all events recorded by either source but without the Chandra/Deming correction.

Techniques used for making demographic estimates from incomplete data are frequently based on the assumption that the unreported cases follow a distribution by some other variable which is similar to that of the reported cases. This assumption would hold true if the reporting of cases depended on random chance. Since, however, random chance has

nothing to do with it, the technique is imperfect but may still be useful -- and the same applies to the Chandra/Deming formula. If it makes an insufficient correction in the right direction, it is justified. Much depends on other factors at play. If the possibility, not to say the likelihood, of matching errors is large, this may overwhelm the effect of the correction and we will not know any more whether the latter will be in the right direction.

In the follow-up method, out-of-scope events are very effectively screened out and the likelihood of matching errors is negligible, but the "correlation bias" between the two interviews, due to the particulars of each vital event and the attitude and ability of the respondent, naturally remains operative. The chance of overcorrection thus having been removed, it would seem logical to apply the Chandra/Deming correction to births and deaths in a quality check match because it will be in the right direction, even if insufficient. While admitting conceptual shortcomings in the formula, it can be recognized as a tool which should be put into use when there is no danger of overdoing it. One should, however, be prepared to find that if the survey and control are in close agreement with each other, and if such is the case, the Chandra/Deming formula may not add anything to the estimate.

Usually most of the conflicting information between the two sets of questionnaires in quality check is not about births or deaths but about whether a person has moved into or out of a sample unit or not. These cases are not exclusively -- not even typically -- matters of simple omission from the part of one of the interviewers. Instead, they spring from the uncertainty over whether a move, an absence or a presence should be interpreted as change of residence. It is therefore not possible a priori to decide which information is correct. Preference might be given to the record of the controller if there is good reason to rely on his carefulness and judgment. However, a more prudent solution is to accept the one of the two sets (survey or control) which gives a larger number of moves. If it is the survey, there will be no correction to be made. If it is the control, the correction factor will be:

$$f = \frac{a + c}{a + b} \qquad (4)$$

After this correction, the lower of the internal migration figures (arrivals or departures) will be raised to equal the higher one.

Table 14 gives the estimates of completeness of the regular interviews in the surveys of Iran, Nepal, the Syrian Arab Republic and Samoa for each survey year. The correction factors are simply the reciprocals of these estimates.

Table 14. Estimated completeness of event recording by regular interviewers in four surveys (percentage)

Survey	Year	Live births	Death	Out-migrants	In-migrants
Iran	1973/74	90.8	80.7		
	1974/75	95.6	92.6		
	1975/76	94.7	95.3		
	Average	95.2	93.9		
Nepal	1974/75	85.5	88.8		
	1976	86.3	90.9		
	1977/78	78.9	77.2		
	Average	83.1	85.5		
Syrian	1977/78	96.7	95.1	89.8	68.3
Arab	1978/79	98.7	97.2	88.1	79.9
Republic	Average	97.4	95.8	89.2	71.7
Samoa	1981/82	91.7	100.0 a/		

a/ Based on less than 20 cases

Types of errors found in matching

Useful insight into the workings of a field survey can be gained in an examination of the complete matching results. Considering for Nepal only the first two years when the operations were more successful and for Samoa the data so far available, the following main types of conflicting information found in matching can be compiled:

Type of discrepancy	Number of cases	
	Nepal	Samoa
Discrepancies regarding move or residence	818	229
Birth not mentioned by other source	138	7
Death not mentioned by other source	33	1
A child born and died not mentioned by other source	24	--
Birth stated by other source as in-migration	--	1
Death stated by other source as out-migration	7	--
Newborn stated as living by one source, dead by another source	3	--

Clearly, the data of Nepal, Samoa and Iran (table 15) indicate that moves and absences become a factor in data capture when the interval between visits is as long as 12 months, as it

was for the control interviewers. Another important part of the omissions relates to children who died soon after birth. These omissions affect both the fertility and mortality estimates to an equal absolute extent.

Table 15. Live births missed by either source in the Iran survey

Reason or circumstance	Missed by survey	Missed by control	Total
Child died soon after birth	4	4	8
Recorded as still born	1	--	1
Recorded as born before survey year	4	--	4
Mother recorded as still pregnant	1	--	1
Migration or temporary absence	4	17	21
No apparent reason	6	4	10
Total	20	25	45

Another option that may be considered for the matching is to do it separately for deaths of children who were born in the same survey year. These have been missed more often than deaths of adults and if they are the cause of a large correction factor, adult mortality would be overcorrected. Surprisingly, when in 1975 in Iran the non-matched deaths were tabulated by age, no indication of selectivity by age was seen. In 1976, however, all five deaths missed by survey and found by control were of infants. It would be advisable to keep the options open and to examine the results of matching before deciding on how to apply them. The limited number of cases places a very tight constraint on splitting them, however, and if -- for example -- deaths are divided into infant and other deaths, it will hardly be possible to maintain a separation into urban and rural areas at the same time. An examination of the results would indicate which division is more relevant in the case.

In the four surveys the control data have been used only for assessment and correction of results and not for making actual corrections in the information on the regular questionnaires. Corrections on these would not be very meaningful because a great majority of the questionnaires remain outside of the control subsample and could not be corrected even though they are assumed to be affected by an equal level of errors. It is now necessary to examine the repercussions of this procedural rule.

Among the errors and omissions in the questionnaires there are some which, once they

have been made, will not or are not likely to ever be corrected (except in quality control), and others which are susceptible to correction at a subsequent visit. In the first category belong omissions of children who are born and die between two successive rounds or otherwise during the same year. These form a potentially important group which will affect both natality and mortality estimates and which should be reduced by careful interviewing and pregnancy follow-up and measured by rigorous quality control. To the same elusive category belong deaths in households which subsequently move out and births to mothers who later move out. Once missed, such cases are not likely to be captured at all.

Among omissions which may be -- and are even very likely to be -- made good at a later round are births of children who survive in the sample area and deaths of persons whose household members remain in the area. The extent of such omissions is supposed to be reflected in the completeness estimates based on quality control. Now, if this is successfully done and if any of the missed cases are later on recorded as current births and deaths, the result is an overestimation of natality and mortality. Logically, therefore, late reports which are made after the survey year in which they occurred, should be classified as corrections to population and not as new vital events. It is, however, somewhat doubtful whether such a distinction can always be made, because the dates of past events are often only vaguely remembered.

Moves to and from sample areas also belong to cases susceptible to being captured later, if missed one or more times. The relevant questions are made at every visit, and thus the possibility of a departure or arrival remaining unrecorded diminishes with each passing round. If, on the other hand, an out-migrant whose departure was not recorded later returns to his household, his absence will remain unrecorded, but there is no harm in this if the survey studies only permanent changes of residence. The same is the case of an in-migrant who escapes recording but then moves out again.

The recording of migration is complicated by the fact that it is not always a clear-cut event. The person involved may have repeatedly changed his mind from a short stay to a permanent one or vice versa. A definite change of residence may have involved several trips back and forth. From this stems the difficulty of determining whether there has been a change of usual residence and, when such has been definitely established, of determining when it actually occurred. It would therefore seem possible to accept the verdict of the man on the spot, the interviewer, trusting that if he is in error, the matter will be corrected at one of the next rounds.

In- and out-migrants are inevitably recorded in the control interviews, and since this is done, it is useful to study and match them as was done in Nepal and the Syrian Arab Republic, but it does not necessarily follow that correction factors should be derived and applied in all circumstances. If they bring the estimate of internal migration into a rough balance, there is a reason to do so, but as a general rule it is more advisable simply to prepare a second estimate based entirely on the control interviews and to make a judgement according to the findings.

It may be said in conclusion that all correction formulas are imperfect and that in each actual case they are imperfect to an unknown extent. Their application in a schematic

mechanical manner should never replace field supervision and actual observation of what happens in the course of data collection and data preparation.

Special considerations in the follow-up method applied to migration and pregnancy

Different migration surveys have used very different definitions of migration. This is understandable because the specific questions to which the research is addressed call for different emphasis in the criteria used. 9/ On the other hand, the migration concepts underlying the data derived from population registers and censuses follow their own logic and satisfy certain objectives which may not be those of the survey taker. In fact, the multiplicity of legitimate study objectives regarding population movement can hardly be satisfied by any single survey. A choice has to be made.

It is generally considered that vital rates for subnational areas are more meaningful when calculated by place of usual residence than by place of occurrence. Population registers and de jure censuses also yield migration data according to the principle of usual residence. In follow-up surveys any other than residence principle would create considerable difficulties in interviewing, in data preparation and in data processing, in addition to a loss of relevance. Using the residence concept, the follow-up method will measure migration as changes in the usual place of residence. This corresponds entirely to the definition of migration given in Methods of Measuring Internal Migration and Multilingual Demographic Dictionary. 10/ Generally speaking, a rather restrictive, conservative definition is called for which, for example, does not lightly separate members of a family nucleus (spouses and their dependent children).

There is no doubt that migration so defined excludes a considerable amount of movement that is relevant to full assessment of social, economic and demographic change in places of origin and destination. 11/ When the interval between survey rounds is a year or even six months, seasonal and short-term mobility will necessarily be incompletely recorded. 12/ In this method it is necessary to separate the two kinds of population movement -- permanent and temporary -- and to study them separately, if both are among the objectives.

While the main follow-up survey will provide data on migration as change of usual or permanent residence, ancillary studies can be attached to selected survey rounds using special questionnaires to collect in-depth data on a category or subsample of households or persons such as recent in-migrants or family members or neighbours of out-migrants. The enquiry may, according to need, cover seasonal movement, circular moves, short-term moves and commuting. It may also include a lifetime migration history.

A factor that should not be overlooked is that many residents of big cities in the developing countries maintain close ties with their ancestral village so as to virtually have two places of residence at the same time. In a census or survey, they may declare their usual residence according to what they perceive as being more prudent or advantageous to themselves. They may return to the home village not only for visiting but for seasonal agricultural work, for delivery of a child or other family reasons, when unemployed etc. Some such moves are seasonal or short term; others are made without knowing how long they

will last, and intentions change when hopes of employment or housing are unfulfilled. The result is often a great deal of travelling back and forth which defies easy definition and clear-cut dating of the move. These situations may be especially vexing in the study of return migration.

Classification by time and space

The mobility of population needs to be classified both in time and in space. In relation to time, the following categories may be differentiated:

1. Movements in which the person ends the day in the same place where he started it;

2. Short-term movements which involve a stay of at least one night and may be prolonged, but temporary, periods away before return to the place of departure;

3. Seasonal movements, which tend to be repeated year after year in the same season, in a cyclical manner;

4. Changes of usual residence.

The term "mobility" may be understood to encompass all four categories of movements although category (1) is often excluded; however, regular moves of this kind (called pendulum movements, or commuting) are receiving increasing attention as a special subject, particularly where they occur across administrative boundaries and for reasons of employment.

The term "migration" in its wider sense covers categories (2), (3) and (4), all of which influence the de facto population. Seasonal migration, as the name implies, is tied to seasons and therefore usually in some way to climatic factors. It may involve individual family members who move alone or entire population groups and may extend across national boundaries. Since seasonal migration is usually linked with economic activity and may be an important factor in lifestyle, there is great interest in it.

In its more restricted sense the term "migration" covers only moves of category (4) which affect the de jure population only and which is differentiated from category (2) by the definition of usual residence. It is in this more restricted sense that migration has been understood in most population censuses and in nearly all demographic follow-up surveys, including all the four surveys specially examined in the present report.

In relation to space the following categories can be divided:

(a) From one living quarter to another within the same area unit (cluster);
(b) From or to the area unit but within the same locality;
(c) From or to another locality in the same country;
(d) From or to a foreign country.

Mobility of category (a) are taken account of so as to update household compositions and addresses but they are not statistically treated and the possible existence of more than one locality within a cluster has been ignored. Movements of category (b) must be statistically treated because it affects the sample population but it is not considered to belong to migration. Categories (c) and (d) constitute, respectively, the internal and the international migration insofar as they involve a change of usual residence. As a matter of clarification it may be pointed out that in categories (b) and (c), it is immaterial whether the opposite end of the move also happens to be in an area unit of the same survey; no attempt is made for establishing such connections. Thus, categories 4 (b), 4 (c) and 4 (d) are statistically processed while only categories 4 (c) and 4 (d) are included in the measurement of migration.

In many surveys locality has been accepted as the entity beyond which a move becomes migration. In other words, changes of residence between localities are considered migration, but changes within a locality are not. Locality is defined according to the international recommendation as "a distinct population cluster (also designated as inhabited place, populated centre, settlement etc.) in which the inhabitants live in neighbouring living quarters and which has a name or a locally recognized status". 13/ In the context of most countries, a city, a town and a village are typical examples of locality.

Migration data derived from censuses or civil registration are customarily tabulated not by locality but by minor civil division (district, subdistrict, commune, municipio, canton, arrondissement etc.) which in a rural area would often comprise a number of localities. Origins and destinations are then not specified below this level. Migration in such case is operationally defined as a change of usual residence from one civil division to another. For the sake of comparability, the same definition could be considered also for a survey. Care should, however, always be taken to use concepts to which reliable answers can be obtained. In some countries people are used to thinking in terms of minor civil divisions but in many others they are not, and any destination of out-migrants beyond the limits of the village would be difficult to ascertain unless it is a well-known city. A pre-test could be most helpful in showing the possibilities in this respect.

Migration

The follow-up method produces two migration samples: out-migrants and in-migrants. While single-round surveys can only reach in-migrants and censuses can yield data for the construction of net internal migration, the follow-up method is particularly strong in measuring out-migration, its volume, its fluctuation in time and the previously recorded characteristics of the migrants. 14/ It is not always successful in recording the destination of the out-migrants, and naturally many other circumstances of the move can only be recorded after the event and therefore from in-migrants only. The data on in- and out-migrants, simultaneously collected from the same sample, therefore complement each other in a very useful way.

In any given country in any given time period, out-migration by definition equals in-migration. If, therefore, a geographical area sample used in a survey adequately represents the country's population and if the recording is accurately done according to the same criteria, then the two samples -- once the international migrants have been removed -- will be of equal

size, give or take a sampling error. In self-weighting samples, the two figures can be directly compared; in other cases, the comparison can be made between the two composite estimates.

Actual surveys, however, have not resulted in two nearly equal internal migration figures but have regularly shown an imbalance of data, out-migrants outnumbering in-migrants. This point is illustrated with data obtained from 11 different surveys (table 16). Though six of them include also international migration which is not necessarily balanced, this has been an insignificant factor in all except Nepal and Cyprus, and even there it does in no way explain the large discrepancy. In most of the cases shown, the difference between in- and out-migrants is far too large to be due to sampling error. It appears then that the surveys have been affected by a systematic error. The possibility of frequent, large-scale overrecording of in-migration is ever present for either of two reasons: sample inadequacy, and response errors.

Concerning sample inadequacy, it must be recognized, first of all, that by the time a survey is being conducted, the sampling frame is almost inevitably to some degree obsolete. Depending on the sampling scheme, newly settled areas and newly constructed buildings may therefore have no representation in the sample. It should be remembered that all inhabitants of such buildings are recent in-migrants, at least by the wider definition which comprises intra-locality moves. Therefore, while the obsolescence of the frame may have only a slight effect on estimates regarding the general population and the out-migrants, it has an immediate and serious effect on the recording of in-migrants.

Response errors may affect both in- and out-migration, but the particular interview technique used in the follow-up is likely to record out-migrants more successfully. The question regarding them is "Is X still living here?", while for in-migrants it is "Has anybody else moved into this household?" The first question leans on an existing record of a person known by name, and therefore his departure is less likely to be missed, intentionally or by oversight, than an arrival. 15/

In table 16 the only cases where recorded in-migrants outnumber out-migrants are the urban sectors in Indonesia (Java and Madura), Iran and the Syrian Arab Republic. Since, however, urban areas usually show a positive migratory balance, this is to be expected, and the urban ratios which exceed 100 in Indonesia and Iran may still hide incomplete recording of in-migrants. Even in these countries, the national data show more out- than in-migrants.

The Iran survey data point to another possible explanation of the imbalance between in- and out-migrants. From this survey it was learned that some persons who, at a later round, were found to have been earlier omitted by mistake were hence added to the sample and, on the other hand, persons who were later found to have been erroneously listed were therefore deleted from the sample. The first-mentioned category was quite large during the first year: about 5 per cent of the population had been omitted in the initial listing.

Table 16 Out-migrants and in-migrants as recorded in selected follow-up surveys

Survey		Out-migrants	In-migrants	Ratio a/
Cyprus, 1980/81 b/	Total	3 411	2 155	63.2
Honduras, 1970/72	Total	17 004	14 692	86.4
Indonesia, (Java and Madura) 1961/62 b/	Urban	7 367	7 612	103.3
	Rural	6 187	4 793	77.5
Iran, 1973-1976	Urban	5 189	5 765	111.1
	Rural	7 935	3 860	48.6
	Total	13 124	9 625	73.3
Nepal, 1974-1978 b/	Urban	6 167	3 199	51.9
	Rural	6 845	4 256	62.2
Nigeria, 1965/66 b/	Rural	25 109	22 334	88.9
Nigeria, (Lagos) 1967/68 b/	Urban	5 539	5 195	93.8
Panama, 1975-1977	Total	11 479	9 470	82.5
Peru, 1974-1976 b/	Total	14 588	10 537	72.2
Samoa, 1981-1983	Total	4 155	3 345	80.5
Syrian Arab Republic, 1976-1979	Urban	2 358	3 066	130.0
	Rural	3 680	2 800	76.1
	Total	6 038	5 866	97.2

a/ In-migrants per 100 out-migrants.
b/ Including international migration.
c/ Including all departures from and entries into sample dwellings.

Yet even in the following years numerous corrections were made, and among them the ratio was five additions to every deletion. The likely explanation is not that even in the second and third year many persons were found who had been missed every time since the beginning of the survey. More likely they arrived during the survey period but were at first considered temporary visitors and therefore not recorded. When their stay in the area was prolonged, it eventually became obvious that they were residents. They were accordingly recorded though perhaps not as new in-migrants but as persons previously omitted. 16/

In most earlier surveys, migration data have been accepted as recorded. In Iran, Nepal, Samoa and the Syrian Arab Republic, however, it was considered that the higher out-migration figure was more correct than the in-migration figure. In the presentation of the

data, the in-migration figure was raised to the same number as the out-migration. The underrecording of recent in-migration in the 11 surveys discussed here raises the question whether surveys in general as well as population censuses are subject to similar underrecording of in-migration which, however, remains undetected as there are no out-migration data for comparison. 14/

Considering first the possibility of faulty coverage, even a slightly obsolescent frame -- and that is to say almost every frame -- affects migration estimates based on interviews at the point of arrival. All data on in-migrants in sample surveys are therefore liable to be too low. In a longitudinal survey, this fault increases with each passing year unless the frame is updated. On the other hand, longitudinal surveys offer the possibility to collect data on out-migrants which are far less vulnerable to inadequacies of the frame. Population censuses usually reach good area coverage and are then not affected at all by this particular factor.

Migration estimates based on in-migrants will generally have larger sampling errors than those based on out-migrants because of the usually higher clustering of the former. In the multiround demographic survey in Cyprus in 1980/81, in-migration was studied both through retrospective and follow-up methods. The study found that in retrospective questioning, respondents tend to understate their past migration experience. 18/

Pregnancy

The pregnancy follow-up is a study within a study. It draws its information from the same survey interviews as the general follow-up of the sample population but is limited to studying what happens after a woman has once told the interviewer that she is pregnant: what will be the outcome of the pregnancy, and if a child is born from it, how long will it survive? The cases followed in it are by no means excluded from the general follow-up but treated and processed integrally, as are all the others belonging to the sample population. But they are, in addition, treated and processed as a separate panel.

The follow-up of the pregnancy panel is carried out according to its own logic and own rules which are explained below. While in the general follow-up we observe a population as it lives and moves in and out of sample areas, the pregnancy follow-up is a true panel study to which cases are admitted only through the fact that a woman declares that she is pregnant at the time. All such cases recorded during a given survey round constitute one pregnancy cohort, which is then closed for new admissions. If a woman fails to declare the fact and at the next round is still pregnant, she may say so and will then be admitted to the pregnancy cohort of that later round. A pregnancy will, however, never be admitted to the study in retrospect, during or after childbirth, as that would distort the probabilities which are being studied.

Children who are born alive from pregnancies in the panel will form a new and equally exclusive panel of child follow-up, with no new cases admitted. The children may either be followed in original pregnancy cohorts or -- what may be preferable -- regrouped into birth cohorts corresponding to the survey round at which the birth was recorded. The child follow-up encompasses the cases of pregnancy follow-up, minus the cases which did not result in a recorded live birth and augmented by the cases of multiple live births. The child

follow-up therefore is simply an extension of the pregnancy follow-up, since every child in it has his origin in a previously recorded pregnancy.

The pregnancy panel is subject to attrition, because pregnant women who move permanently out of the sample areas cannot be effectively followed any longer. For some cases simply no further information is obtained. The child follow-up panel is subject to similar attrition through out-migration, death and loss of contact.

Operated as a panel study and its results expressed in the form of probability functions, the pregnancy follow-up has two objectives: to measure pregnancy wastage (abortion and late foetal death levels); and to provide a second, partly independent estimate of infant mortality. In pursuing the first objective, pregnancy follow-up is a technique by far more promising than any other sample survey method so far proposed. For the second objective, the technique is, among survey methods, also unrivalled in accuracy of data recording. It has the potential weakness of incomplete and therefore possibly biased coverage. If a large proportion of the women in the sample do not want to say that they are pregnant, then those who do want to say so may be a non-representative group, subject to different risks than the entire sample and the universe. The representativity of the pregnancy follow-up panel can be measured by comparing the demographic and social characteristics of the mothers of live-born children in the panel with those in the whole sample. Generally speaking, the higher the participation in the panel, the more representative are the data it yields.

From what is said above, it should not be concluded that every effort should be made to ensure complete recording of pregnancies. The highly successful recording in the Syrian Arab Republic and Iran, which surprised the survey takers themselves, was achieved by the "soft" approach in which the question was always asked, but without insistence, so as not to intrude into an area the respondent perhaps did not want to discuss. Again incompleteness, through more intensive questioning, might be offset by an erosion in the veracity of subsequent replies and by a deterioration in public relations which might affect the entire survey.

It may be pointed out in this connection that any survey -- say, a single-round retrospective -- which collects data on pregnancy wastage and infant mortality is, to an even greater extent, vulnerable to purposive withholding of information and selective answers, even if it claims a 100 per cent response rate.

According to the experience gained in demographic surveys, it is the deaths of newborn children that are most likely to escape notification. If the death occurs within minutes of the birth, the child is often considered stillborn, and in some countries the legislation allows a child who died within several days to be registered as late foetal death. In surveys, the fact that the child is not there makes him more likely to be omitted, the interviewer lacking the reference and the responding parent perhaps being reluctant to mention the case.

However, if the fact of pregnancy has been recorded already at some time during the gestation, then it will be easier in due time to enquire about its outcome and the survival of

the child. The case can no longer be forgotten or quietly avoided. There will still be possibilities of incorrect information, but the main sources of errors can be brought under control and with careful questioning even virtually eliminated. 19/

Recording pregnancy

In pregnancy follow-up, it is not acceptable to, for example, first record a birth and then reconstruct the facts of the pregnancy, or to start with an infant death and then to record the birth, because backtracking will invalidate the probabilities which are needed for the estimates. On the other hand, once a pregnancy has been recorded, the record should not be later destroyed for any reason. If the information later proves to have been false, that fact should be indicated. Every recorded case should be followed to a conclusion, even if it is only to admit that no further information was obtained. Such facts are of interest for purposes of evaluation.

To collect the information, each currently married woman of child-bearing age should be asked at every round whether she is pregnant at the time and, if so, how many months. Affirmative answers will be entered in the questionnaire, where in due time the outcome of the pregnancy will also be indicated.

For easy derivation of results, it is practical to enter all the information concerning the same pregnancy and its offspring, collected at different dates, in a single longitudinal record -- a card or a form -- and to arrange them into a card index or file to serve as the focal point for data storage and data processing.

A single card or form for each recorded pregnancy may be used through the entire sequence: woman, pregnancy, its outcome and child survival. In the case of multiple births, additional records will be started from the time of birth. An alternative solution is to prepare another set of records for child follow-up (but only for children issued from pre-recorded pregnancies): this makes it easier to use the records for data processing at any time, when wanted.

The pregnancy follow-up record should have information on the woman herself, on the facts of the pregnancy and its eventual outcome, and on the survival or death of the live-born child. (A card of this type, used in the Samoan survey, is reproduced in fig. I.) The record might also contain information on the survival of the woman, although in the surveys discussed here, that was not done.

A list of items that would be useful to include in the pregnancy follow-up record -- provided those data are collected on the survey questionnaire -- is given below. It is basically those topics recommended in Principles and Recommendations for a Vital Statistics System for the collection of vital information using the registration methods. 20/ Since the survey questionnaire is usually kept very concise, the list as given is far too long in most cases. On the other hand, with an additional questionnaire, many more items could be introduced. Items that are considered important for the derivation of basic estimates are marked with an asterisk (*).

(a) Initial information

* Pregnancy index number (composed of cohort number and serial number within cohort)
* Survey household number
* Name of expectant mother
* Date when pregnancy was recorded

Date when pregnancy started (onset of last menstrual period)

* Gestational age, when recorded
* Age

Marital status

* Educational level
* Number of children born alive

Date of last live birth
Date of first marriage
Ethnic group
Socio-economic group

(b) Outcome of pregnancy

Date when pregnancy ended

* Date when outcome was recorded
* Final duration of pregnancy (months)
* Outcome: live birth: single/twins/triplets
  still birth: single/twins/triplets
  abortion
  death of expectant mother
  moved out
  not pregnant
  no information

(c) Child follow-up

* Child index number (composed of birth cohort number and child's serial number within cohort)
* Name of child
* Sex
* Single or multiple birth
* Date of birth
* Date of death
* Status at various dates:
  living
  dead
  moved out
  no information

Whether currently being breast-fed

The above list follows approximately the ones prepared for the Syrian Arab Republic, Samoa and Malaysia and for the World Health Organization. It excludes questions on maternal deaths and various items of clinical information which it may not be feasible to carry in a demographic survey.

After the first survey round, a record is prepared for each woman who was recorded as pregnant, with the information entered in part (a). There cannot be any information yet for parts (b) and (c). It should be remembered that it would be against the logic of follow-up to fill in part (a) when the outcome in part (b) is already known, for doing so would misrepresent the probabilities of outcome. All cards generated by one survey round constitute one pregnancy cohort, which should be indicated in the card number. Each pregnancy cohort should be kept separate until it has in its entirety passed through the pregnancy.

The gestational age (in months or weeks) should be recorded for every pregnancy, according to the indication of the respondent, preferably the woman herself. The answer may be understood to indicate the number of missed menstrual periods, since the gestational age according to international definition is counted from the onset of the last menstrual period. 21/

It can be argued that errors in gestational age when first reported can be corrected once the child is born. This might be true in many cases if the recording was done at the time of abortion or delivery by a physician or trained midwife, but it cannot be done with a likelihood of success in a lay interview afterwards. Moreover, gestational age as reported by the expectant mother at the first time is a valuable item of information, per se, with prognostic value and helping to understand the whole process of pregnancy follow-up; it would be destroyed by later, doubtful corrections by the interviewer.

Pregnancy follow-up

Beginning with the second round, the survey will yield information on the outcome of the pregnancies, although for some of the cases the outcome will be known only several rounds after they were first recorded. Part (b) is filled in and in cases where a child was born alive, the first entries in part (c) also. If the outcome is other than a live birth, the record is now complete and becomes inactive.

In part (b), seven possible outcomes of the pregnancy are listed. There may be a situation in which the woman in question is pregnant. If this is the case, the interviewer has to ascertain whether she is still pregnant or again pregnant; in the latter case, both the outcome of the earlier pregnancy and the start of the new are recorded.

The distinction between abortion and late foetal death may often be made more reliably on the basis of the vernacular words used for them than by calculating from the given dates. Internal analysis would show whether the separation of the two categories reached in that way corresponds to the internationally defined 28-week limit.

It could be of interest to distinguish between spontaneous and induced abortions. However, where abortion is either illegal or not considered acceptable, it is not advisable to attempt this. In such societies, a woman who would be considering an abortion would very

likely not mention her pregnancy at all. Alternatively, she might declare an induced abortion as a miscarriage or say that she had been mistaken and had not been pregnant at all.

Successful distinction between a live birth followed by death and a foetal death depends on the carefulness of the interviewer, who needs to be taught the definition of "live birth": breathing or any other sign of life after complete separation from the mother. In most cultures, errors probably tend to shift some live births to foetal deaths and thus to lower the infant mortality rate while increasing the late foetal death ratio. Whether this has happened can to some extent be gleaned from a comparison of the two indicators, the sum of which is not affected by this kind of error.

Child follow-up

The purpose of the child follow-up is to estimate the infant mortality and possibly the childhood mortality after the age of one year. It takes account only of cases initially recorded as pregnancies.

When a child has been born alive (even if she is dead at the time of reporting), part (c) is filled in with all the required information on the birth and the first line of follow-up, which will state the date of information (survey interview) and whether the child at that date was living, had died or had moved out from the area. In case of live-born twins, another record is prepared, and in case of triplets, two new records are prepared. On each such record should also be written information on the mother, because it will be cross-classified with child follow-up data. However, it is recommended that the information on the outcome of pregnancy not be entered, so as to avoid any possibility of duplication of pregnancy data in case of some possible later processing. Again, it should be remembered that no child should be included in the child follow-up unless the mother was recorded as being pregnant at an earlier round. Each new survey round will bring fresh information on each surviving child, and that information should be entered promptly on the child's record. It is not advisable to separate the records of dead or out-migrated children from the file, since they remain an essential part of any tabulation.

Processing considerations

The records of a given pregnancy cohort may be processed as soon as all of them have passed through the entire period of gestation and information on the outcome has been recorded (which may, of course, in some cases mean "no information obtained"). The records will be edited and coded and then tabulated manually or mechanically. It is of obvious value for the survey takers to produce some basic information on each pregnancy cohort as soon as possible, but a comprehensive tabulation programme may wait until a large enough body of data has been accumulated. The data for new cohorts will thus be successively added to the pool, but it is important never to break up a cohort and join part of it to the pool, since that would distort the results: information on abortion is available earlier than on cases brought to term. Each cohort has to be treated as an indivisible whole which may only be merged with other complete cohorts.

The data of the child follow-up file may be processed at any convenient time -- e.g., after the information of a field round has been entered. The infant mortality rate can be calculated as soon as a substantial number (at least a few hundred) of live-born children, issued from the pregnancy follow-up, have passed through the first year of life and information on their survival or death has been recorded. The calculation will be considerably simpler once an entire cohort has passed through the first year of life.

If the survey lasts a long time (say, more than three years), it will be of interest to process at least certain basic data for periods of approximately 12 months and thus to obtain a time series of infant mortality. Detailed cross-tabulations, however, gain value from larger numbers and are more advantageously prepared for accumulated materials.

Examples of the pregnancy follow-up

The nature of the pregnancy follow-up study is illustrated by the following overall data which indicate the magnitudes of the different categories of cases encountered in the follow-up surveys of Samoa and the Syrian Arab Republic.

	Syrian Arab Republic	Samoa
Recorded pregnancies, total	6 864	658
Mistakenly recorded as pregnant	48	6
Actual pregnancies, total	6 816	652
Still pregnant at latest report	1 147	133
Moved out of area while pregnant	437	74
No further information obtained	10	2
Pregnancies with known outcome	5 222	443
Abortions	256	10
Deliveries	4 966	433
of which twins	54	5
Total children born	5 020	438
Late foetal death	99	3
Born alive	4 921	435

In these surveys mistakenly recorded pregnancies represent roughly 1 per cent of all those for which the outcome became known. Even at the gestational age of one month, the error rate is less than 2 per cent. The low proportion of mistaken reports makes it evident that the recording was done only when the respondent was fairly sure of her condition.

The mobility of the people has a disturbing effect on follow-up. The women who moved out of the area after having been reported pregnant numbered 16.7 per 100 in Samoa and 8.4 per 100 in the Syrian Arab Republic.

The low number of women for whom no further information was obtained -- ten and two, respectively -- indicate how easy follow-up is when people do not move away permanently.

No multiple late foetal deaths were recorded, which may be due to chance or omission; among the 102 late foetal deaths, one or two pairs of twins could normally be expected. Among live births the frequency of twins was close to the generally prevailing ratio of about 1:80.

Three abortions were recorded in the Syrian Arab Republic in pregnancies that were first reported at seven or eight months' gestation. Assuming that the gestational age was correctly given, these were -- by definition -- late foetal deaths, and were so classified.

Notes

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Chapter IV

CALCULATION OF VITAL RATES USING SURVEY RESULTS

This chapter presents selected results of the surveys of Iran, Nepal, Samoa and the Syrian Arab Republic based on the survey status classification discussed in chapter III. Because of the special characteristics of the follow-up approach, the calculation of infant mortality by two different methods -- the two-component method and the pregnancy follow-up method -- are discussed. In order to have a better understanding of the results, mean features of the four follow-up surveys are given in table 17.

Population change and its components

Fertility

A sample of about 40,000 persons produces annually crude birth rates, total fertility rates and gross reproduction rates with very acceptable accuracy at the national level. It gives tentative urban/rural and age-specific rates which will become more firm when the results of a second and third year are added. Subnational birth rates may be considered tentatively usable when they are based on about 10,000 person-years and quite accurate once 30,000 to 40,000 person-years have been accumulated. Table 18 summarizes the more common fertility indicators for four countries.

Mortality

Crude death rate

The crude death rate annually produced by the survey can be expected to have a larger coefficient of variation than the crude birth rate but an actual sampling error per 1,000 population most likely lower than for the birth rate, because the death rate itself is lower. This means that for the estimation of population growth, annual death rates can be expected to be about as satisfactory as the birth rates. Table 19 gives the crude death rate from four surveys.

Age specific death rates require such large volumes of observations before they can be calculated independently that few surveys can produce them. In smaller surveys, life tables have to be very carefully constructed or the data fitted to some model life table, which, of course, is a result of less value.

Infant mortality

Infant mortality is customarily calculated as the number of deaths of children under one year of age per 1,000 live births during the same time period, usually one calendar year. This is sufficiently accurate when the number of births has not changed much from the previous year, but if it has changed, the rate will be distorted because some of the children who die under the age of one year during a given year were born the year before.

Table 17. Main features of four demographic follow-up surveys

Item	Iran 1973-1976	Syrian Arab Republic 1974-1978	Nepal 1976-1979	Samoa 1981-1985
Total population at the beginning of the survey years (millions)	31.2	12.3	7.7	0.16
Mean total sample size (persons)	99 490	77 405	42 228	16 291
Number of area units (clusters)	165	191	61	93
Mean cluster size (persons)	603	405	692	175
Duration of survey (years)	3	3	3	4
Intervals between rounds (months)	6	6	6	6
Objectives	Fertility Mortality Mortality	Fertility Mortality Mortality	Fertility Mortality Mortality	Fertility Mortality
Strata	Urban/rural Province	Urban/rural 4 strata	Big cities Other cities rural	Urban/rural
Sampling fraction	Uniform	Varies by strata	Uniform	Uniform
Quality check	1/9 two-stage	1/10 one-stage	1/10 one-stage	1/10 two-stage
Pregnancy follow-up	Yes, not processed	No	Yes	Yes
Estimated completeness				
Births (percentage)	95.2	83.1	97.4	91.7
Deaths (percentage)	93.9	85.5	95.8	

Table 18. Various fertility indicators in four surveys

Indicator and survey	Total	Urban	Rural
Crude birth rate (per 1,000)			
Iran, 1973-1976	41.8	32.5	48.8
Nepal, 1974-1978	44.7	30.2	46.3
Syrian Arab Republic, 1976-1979	43.0	38.5	47.1
Samoa, 1981-1983	31.0	..	..
Total fertility (per woman)			
Iran, 1973-1976	6.26	4.42	7.78
Nepal, 1974-1978	6.27	3.83	6.37
Syria Arab Republic, 1976-1979	7.3	6.0	8.6
Samoa, 1981-1983	4.91	..	..
Gross reproduction rate (per woman)			
Iran, 1973-1976	3.05	2.16	3.80
Nepal, 1974-1978	3.04	1.91	3.09
Syrian Arab Republic, 1976-1979	3.50	2.88	4.12
Samoa, 1981-1983	2.39	..	..

Table 19. Crude death rate (per 1,000) as recorded in four surveys

Survey	Total	Urban	Rural
Iran, 1973-1976	11.5	8.3	13.9
Nepal, 1974-1978	19.6	10.6	20.3
Syrian Arab Republic, 1976-1979	8.2	6.7	9.6
Samoa, 1981-1983	7.4	..	..

In multiround surveys, even when there has been no appreciable change in the number of births, there may be a considerable difference between the number of children recorded at the first survey round as being under one year of age and the number of live births recorded during the year that follows. The latter figure, based on follow-up observation, is likely to be more correct, while the former is liable to underenumeration, in addition to early mortality. For example, in the Iran survey the two figures were respectively 2,516 and 3,278. The reason for the smallness of the former figure was stated to have been an underrecording of infants, either through omission or through overstatement of their ages, since many children were declared to be one year old when in fact they were still short of one full year. 1/

Another reason which may make conventional infant mortality rates unreliable is that among largely illiterate populations, age at death often can not be reliably determined. If credence is given only to having recorded each vital event in the correct time interval -- and it is in this respect that the follow-up method is most accurate -- then the infant mortality may be calculated with satisfactory approximation by a two-component method, explained below.

Rates calculated by the conventional and the two-component methods are liable to be affected by the general tendency to incomplete recording of early deaths, unless this can be compensated by the correction factors obtained through quality check. This weakness is essentially overcome in pregnancy follow-up, which therefore can yield the most accurate infant mortality rates, provided its coverage is representative of the whole sample. There are thus three alternative ways for calculating the infant mortality rate in a follow-up survey:

(a) Adjusted conventional method with correction;
(b) Two-component method;
(c) Pregnancy follow-up method;

Conventional method with correction

In this method, the infant mortality rate is obtained from:

$$q_o = \frac{d_o}{b} \cdot \frac{f_d}{fb} \qquad (4.1)$$

where f_d = correction factor for deaths

f_b = correction factor for births

d_o = deaths under 1 year of age during survey year

b = live births during survey year

Two-component method

In this method, two components of infant mortality are calculated separately, both as probability functions, and then combined to give the complete rate. The first component measures the risk of live-born children to die during the year of birth, while the second measures the risk of those who survive their year of birth to die before the age of one year.

The first component is obtained from the equation:

$$q_o' = \frac{LBD}{LB - 0.75 \times LBMO} \cdot \frac{f_d}{f_b} \qquad (4.2)$$

the second component from the following:

$$q_o'' = s \frac{f_d \times D_o}{L_o + D_o + 0.25\ (MO_o + MI_o + A_o)} \qquad (4.3)$$

and the complete infant mortality rate from:

$$q_o = 1 - (1 - q_o')\ (1 - q_o'') \qquad (4.4)$$

where:

f_d = correction factor for deaths

f_b = correction factor for live births

LB = live-born

LBD = live-born who died during the year of birth

LBMO = live-born who moved out during the year of birth

L_o = children under 1 year of age at beginning of year who survived the year

D_o = children under 1 year of age at beginning of year who died during the year

MO_o = children under 1 year of age at beginning of year who moved out during the year

MI_o = children under 1 year of age who moved in during the year

A_o = children under 1 year of age who were added to the sample during the year

s = separation factor (proportion who die under 1 year of age out of all who die in the year following the year of birth)

A few explanations to the above formulae may be in order.

D_0 in equation 4.3 is not the same as d_0 in equation 4.1 because d_0 includes all infant deaths during the year, while d_0 denotes all deaths in the cohort which was under 1 year of age at the beginning of the year irrespective of their age at death.

The denominators in equations 4.2 and 4.3 are called "follow-through equivalents", meaning that part-exposures are in them converted to full exposures of children who have been followed through the entire observation period in question. The fractions applied to part-exposures -- namely, 0.75 and 0.25 -- correspond to the duration of observation as explained in Chapter III "Person-years at risk" and they do not reflect the varying intensity of the risk at different periods of infancy. It is, of course, possible to construct fractions which do reflect them.

The deaths, like survivors, have always the weight of one, not one half, because we are dealing here with probabilities and not central rates, and a child who has died has therefore been fully followed through.

The separation factor in equation 4.3 divides the deaths in the year following the year of birth into those that occur before and those that occur after the exact age of one year. There may not be materials for determining this factor in many countries, but it can be expected to be always somewhat over 0.5. In some of the surveys the factor 0.55 was used, since this had been found to correspond approximately to the slope of mortality in several countries with a relatively high child mortality. The method will be more precise if it is possible to obtain reliable data about the age at death of children and thus obviate the need for a more arbitrary separation factor.

The two-component method described here has been used for calculating the infant mortality rate in the surveys in Iran (table 20), Nepal and the Syrian Arab Republic. A summary of these rates given in table 21, by urban/rural sector and by sex may be of some interest since it illustrates the environment in which the surveys operated. First of all, they show plainly the disadvantaged conditions in the rural areas, particularly in Iran and Nepal, where the rural rates were twice as high as the urban ones. By an unusual coincidence, the rates of each sector were almost equal in Iran and Nepal but the national rate in Nepal was much higher than in Iran because of the overwhelming size of its rural sector. A particular feature of Iran is the excess mortality of females, which is not limited to infancy but is manifest through childhood and the child-bearing ages. The Syrian Arab Republic has a considerably lower infant mortality than Iran and Nepal; the urban/rural contrast is more moderate while the male excess mortality is more pronounced. Finally, for the first survey years in Samoa, only the overall rate, calculated by the conventional method, can be shown since the basic figures were still too small for breakdowns.

Pregnancy follow-up method

In this method the calculations are limited to infants who were born alive from pre-recorded pregnancies. It is recommended that the calculations be made as in a life table, by detailed age -- e.g., by month of age.

Table 20. Calculation of infant mortality with the two-component method, using data from 1974/75 survey for rural females

First component: mortality in the year of birth

Live births recorded	1 481
Moved out	17
Loss to observation: 0.75 x 17 =	13
Follow-through equivalent	1 468
Adjusted for underrecording	1 509
Live-born who died in the same year	139
Adjusted for underrecording	146
First component: 146/1,509 x 1,000 =	96.75

Second component: mortality after the year of birth before age of one year

Children under one year of age at beginning of year, according to final status:

Status	Number	Weight	Follow-through equivalent
Living	994	1	994
Died	78	1	78
Moved out	48	0.25	12
Moved in	6	0.25	1
Added	15	0.25	4
Total			1 089
Deaths recorded among the above			78
Adjusted for underrecording and to one year			79
Death rate: 79/1,089 x 1,000 =			72.54
Before age of one year: 0.55 x 72.54 =			39.90

Total infant mortality

Live-born children	1 000.00
Deaths in the year of birth	96.75
Survivors to end of year of birth	903.25
Deaths in the following year before age of one year: 39.90 x 903.25/1,000 =	36.04
Survivors to age of one year	867.21
Infant mortality: 1,000 - 867.21 =	132.79

Table 21. Infant mortality rates by sex and urban and rural sector, calculated from the two-component method for Iran, Nepal, the Syrian Arab Republic and Samoa

Country and year	Sector	Total	Male	Female
Iran, 1973-1976	Total	104.5	99.8	109.6
	Urban	62.0	54.9	70.0
	Rural	126.2	122.8	129.7
Nepal, 1974-1978	Total	123.4	126.5	119.6
	Urban	59.0	61.1	56.7
	Rural	125.3	128.6	121.5
Syrian Arab Republic, 1976-1979	Total	57.3	63.4	50.8
	Urban	43.3	54.9	31.5
	Rural	67.5	69.3	65.5
Samoa, 1981-1983	Total	33.0	...	...

The probability of a child who reaches the exact age i to die before the exact age $i+1$ is obtained as follows:

$$q_i = \frac{d_i}{l_i - 0.5\,(m_i + u_i + t_i)} \qquad (4.5)$$

where:

d_i = deaths between age i and $i+1$,

l_i = living at age i

m_i = last recorded alive between age i and $i+1$, after which moved out

u_i = last recorded alive between age i and $i+1$, after which lost to observation

t_i = last recorded alive between age i and $i+1$ after which survey was terminated

The complete infant mortality rate is obtained from:

$$q_o = 1 - (1 - q_o)(1 - q_1)(1 - q_2) \ldots (1 - q_{11}) \qquad (4.6)$$

The calculation is illustrated by an example from the Syrian Arab Republic in 1976-1979 which is for the time being probably the largest and most successful application of the method. It is based on 4,921 live-born children, of whom 1,454 were still under one year of age and living in the sample units at the time of the last survey round.

In table 22 the children who have died are placed in the age group corresponding to their age at death. All others are placed in the age group when they were last recorded as being alive and living in a sample unit. The column l_i begins with the total number of live births and then is progressively reduced by the number of children whose observation stopped for any reason at each age given. The number exposed to risk is the denominator of equation 4.5, and when the number of deaths at the corresponding age is divided by it, the probability of dying at that age (q_i) is obtained. The last two columns are calculated with q_i values, starting from 100,000 live births, as in a life table. When from 100,000 is subtracted the last figure in the penultimate column (in this case 94,616), which indicates the number reaching the exact age 12 months, the difference (5,384) equals the sum of the last column. Divided by 100, this indicates the infant mortality rate per 1,000 live births: 53.84. There is an anomaly in the figures -- namely, the higher risk of dying at age one month than at age 0 month, the reason being that the age at death has not been recorded accurately but often derived from rough dates indicating calendar months. The neonatal mortality (under one month of age) is therefore seriously undervalued and only the figures for the first two or three months together should be used. There is also obvious chance variation in the monthly probabilities due to the small number of cases. It is recommended in such cases either to use the quarter-year age data or to smooth the monthly data.

The infant mortality rate can also be calculated in a single operation from the following:

$$q_o = \frac{d_o}{l_i + d_o + w_1 m_o + w_2 u_o + w_3 t_o} \qquad (4.7)$$

where:

d_o = deaths at age under 1

l_1 = survivors till age of 1 year

m_o = moved out before age of 1 year

u_o = lost to observation before age of 1 year

oi = under age of 1 year when survey was terminated

w = weights indicating the proportion of the full infant mortality risk that the cases had passed and survived

Table 22. Calculation of infant mortality from pregnancy follow-up, Syrian Arab Republic, 1976-1979

Age at latest information, months	Live-born children at latest information					Entering age 1	Exposed to risk	Probability of dying	Per 100,000 live births	
	Dead	Moved out	Not known	Alive	Total				Alive	Dead
i	d_i	m_i	u_i	t_i		l_i		q_i	L_i	D_i
0	58	--	--	78	136	4 921	4 822	.01188	100 000	1 188
1	68	4	--	151	223	4 785	4 708	.01444	98 812	1 428
2	17	8	2	105	132	4 562	4 504	.00377	97 384	367
3	16	30	--	136	182	4 430	4 347	.00368	97 017	357
4	14	27	1	108	150	4 248	4 180	.00335	96 660	324
5	9	35	1	101	146	4 098	4 030	.00223	96 336	215
6	11	44	1	119	175	3 952	3 870	.00284	96 121	273
7	10	32	5	141	188	3 777	3 688	.00271	95 848	260
8	9	29	1	167	206	3 589	3 490	.00258	95 588	247
9	12	25	1	198	236	3 383	3 271	.00367	95 341	350
10	6	33	2	72	113	3 147	3 094	.00194	94 991	184
11	6	31	2	78	117	3 034	2 978	.00201	94 807	191
12	24	289	1	2 603	2 917	2 917	--	--	94 616	--
Total	260	587	17	4 057	4 921	-	-	-	-	5 384

Applying equation 4.7 to the Syrian data in table 22 and using the weights $w_1 = 0.8$, $w_2 = 0.8$, $w_3 = 0.7$, one arrives at an infant mortality rate of 53.37. Uniform weights of 0.7 would give a rate of 53.75. Two infant mortality rates for the Syrian survey were calculated -- namely, 57.3 per 1,000 by the two-component method, and 53.8 per 1,000 by the pregnancy follow-up method. The difference between the two estimates may be partly due to their not having been based on exactly the same data: in addition to 380 births which were not issued from pre-recorded pregnancies, the two-component method takes account also of children who were under one year of age when the survey started. On the other hand, it may be affected by the use of the arbitrary separation factor 0.55. The Central Bureau of Statistics of the Syria Arab Republic considers the rate derived from pregnancy follow-up to be more reliable 2/ and undoubtedly with justification.

It may therefore be concluded that the regular follow-up with its adjustment by quality check did not result in a too low estimate but in one that is probably slightly too high. This is a very different situation from that reported for the Sine-Saloum area in Senegal. There, the infant mortality rate obtained through regular population follow-up without adjustment was calculated as 165 per 1,000, whereas estimated through pregnancy follow-up it was 238; the former figure was thus an underestimation of 37 per cent when judged by the latter. 3/

Foetal mortality

Foetal mortality (also called pregnancy wastage) is by international definition divided into early, intermediary and late foetal deaths, depending on the gestational age when it occurs. The age is expressed in completed weeks since the onset of the last menstrual period. Abortion and still-birth are other commonly used parallel terms. In surveys it may be difficult or impossible to determine the gestational age in weeks since most people are used to expressing gestation in months, actually counting missed menstrual periods. The coverage of the various terms can be seen in the following:

Completed weeks of gestation	Completed months of gestation	Internationally recommended term	Colloquial term
Less than 20	4	Early foetal death	
20-27	5-6	Intermediate foetal death	Abortion
28 and over	7	Late foetal death	Still-birth

Foetal mortality can be calculated with considerable precision from pregnancy follow-up data if the period of gestation (gestational age) is recorded. The late foetal death ratio can be calculated from pregnancies which have first been recorded before seven months (28 weeks) of gestation. For that, it is necessary to differentiate between late foetal deaths, on the one hand, and early or intermediate deaths, on the other.

To calculate meaningful abortion ratios, however, it is necessary to tabulate the pregnancies by gestational age at the time when they were first recorded, because the likelihood that an abortion will still occur depends on it. The complete risk of pregnancy wastage can obviously only be measured by following pregnancies from the very beginning. In practical terms this means from four completed weeks of gestation onwards. This is not always easy in a survey because relatively few women are sure of their condition so early. As a consequence, the earliest risks may have to be calculated from a small number of cases.

If the gestational age when the pregnancy was first reported and the age when it was terminated by foetal death or when the woman moved out of the area are recorded, then foetal death ratios can be calculated in life-table fashion for each gestational age. However, no such data have been published for a demographic follow-up survey so far. The survey that has given the most detailed and complete data on foetal mortality is that of the Syrian Arab Republic in 1976-1979. In that survey of seven semi-annual rounds, all pregnancies recorded at the first five rounds and those recorded at the sixth round as being of gestational age four months and over had come to term before the last round of the survey. The outcome of those pregnancies is given in table 23, twin live births are given as two cases each in order to calculate the ratios in relation to the number of live births as is customary.

Table 23. Calculation of abortion and late foetal death rates, Syrian Arab Republic, 1976-1979

Months pregnant when first recorded	Total	Outcome						Abortion ratio	Abortions between age x and x + 1	Number	Late foetal death ratio
		Live birth	Late foetal death	Abortion	Moved out	Not known	Not pregnant				
1	371	297	6	36	30	–	2	12.1	1.1	6	2.0
2	705	544	14	60	73	1	13	11.0	1.9	14	2.6
3	897	740	19	67	62	1	8	9.1	4.3	19	2.6
4	907	786	11	38	62	3	7	4.8	2.5	11	1.4
5	1 227	1 108	19	25	62	2	11	2.3	0.6	19	1.7
6	740	662	13	11	49	3	2	1.7	1.7	13	2.0
7	352	317	7	--	28	--	--	--	--	7	2.2
8	287	253	7	--	27	--	--	--	--	7	2.8
9	53	45	1	--	7	--	--	--	--	1	2.2
Total,	5 539	4 752	97	237	400	10	43	...	...	97	2.0
1-6 months	4 847	4 137	82	237	338	10	43	...	...	82	2.0

Source: Syrian Arab Republic, Central Bureau of Statistics, Pregnancy Follow-up Study in Syria, 1976-1979 (Damascus, January 1984), pp. 10-11.

The number of cases on which no further information was obtained is very small but there was a sizeable loss from observation due to the fact that about 7 per cent of the women moved out of the sample areas. It is difficult to make any assumption regarding them since some might have had an abortion or birth before moving out. The fact of migration could have an effect on the results if it was selective. Since the survey was based on the principle of usual residence, short-term moves which may be associated with abortion or childbirth do not affect the sample population. Permanent moves usually involve the entire family and are less likely to be motivated by the outcome of a pregnancy. 4/

Abortion ratios are naturally highest in those pregnancies which were recorded early; after seven months of gestation, no more abortions will, by definition, occur. The differentials between successive abortion ratios in the table (see table 23) are indicative of the abortion risk at each month of gestation; the risk is small at the early months, and then rises to reach a peak between three and four months of pregnancy, and declines thereafter again. The form of the curve is subject to chance variation of the relatively small numbers. In particular, the ratio after six months may be too high, due to chance or to classification of late foetal death as abortions or to initial overstatement of gestational age.

The late foetal death ratios do not show any tendency by gestational age, as indeed they are not expected to. Because late foetal death by definition occurs only from seven months on, the ratio is appropriately calculated from all pregnancies recorded before this point. This is the ratio 82:4,137, or 2.0 per 100, as given on the bottom line, and it happens to be the same as that calculated from all cases (97:4,752).

The best estimate of the total abortion ratio is that obtained starting from one month of gestation -- in this case, 12:1. To this should be added the abortions that occurred after four weeks of gestation but before the recording was made some time during the gestational age of four to seven weeks.

Conceptually, the abortion ratio and the late foetal death ratio are additive even when they are not calculated from exactly the same cases. They constitute pregnancy wastage and in the case of the Syrian Arab Republic it would amount to 12.5 + 2.0 = 14.5 per 100 live births. It is believed that this represents spontaneous wastage, since induced abortions are relatively rare. It is likely that a woman who would contemplate inducing one would not declare her pregnancy to the interviewer. The question of induced abortions, their legality, their frequency and their acceptance by the public, are important matters to consider when a pregnancy follow-up project is planned.

The follow-up cards lend themselves well to the study of differentials in foetal as well as infant mortality by various recorded characteristics. As this may result in splintering the material which may not be large to begin with, it is necessary to employ methods that minimize the splintering effect. Among them is the method of expected numbers which is particularly suited for the tasks required here where the numbers are usually small overall, the numerators are small in relation to denominators and several variables may have to be taken into consideration simultaneously. In this method for each subgroup the expected number of deaths, expressed with one or two decimal places, is calculated, assuming it was subject to the same mortality as the material as a whole. On the side of the expected number will be given the actual

number of deaths in the subgroup. No matter how small such pairs of figures turn out to be, they can now be used like building blocks to compose meaningful categories, large enough to display significant numbers. While doing this, the significance of the compiled absolute numbers can always be perceived or can easily be tested against the fact that the standard error of an absolute number in this kind of situation is approximately equal to its own square root. If the difference between the expected and observed number equals or exceeds two times the square root of the higher one, the difference is statistically significant at 95 per cent confidence level. Comparisons involving several categories may be subjected to the x^2 test.

Migration

Migration rates vary widely according to geographical area, and they have a propensity to fluctuate in time in response to economic, social, political or other stimuli and deterrents. Migration statistics reflect all these factors, but in addition they are subject to spurious changes and differences. While births and deaths are well defined, the definition of a move or migration varies from country to country and from one survey to another. Finally, the application of the definition of migration is often difficult, because a move is not always a clear-cut event.

Migration data from a sample are subject to sampling errors which are regularly larger than those for births and deaths. This is partly due to entire families often moving together and partly to a large geographical correlation which increases the cluster effect. An adequate migration sample therefore needs a larger number of clusters than a fertility or mortality sample.

The data in table 24 give out-migration rates for Iran, Nepal, Samoa and the Syrian Arab Republic obtained from the follow-up surveys. The rates are essentially equal in urban and rural areas in Iran and the Syrian Arab Republic; there are no comparable data for Nepal and Samoa.

Table 24. Average annual interlocality out-migration rates per 1,000 population from follow-up surveys

Survey		Total	Urban	Rural
Iran,	1973-1976	48	50	47
Nepal,	1974-1978	--	--	39
Syrian Arab Republic,	1976-1979	67	66	68
Samoa,	1981/82	159	--	--

The follow-up method can also give detailed data on such characteristics of the out-migrants that have been recorded earlier on the survey questionnaire -- age, sex, marital status, education etc. -- and makes the estimation of migration volumes at the national level possible. The surveys of Iran and Nepal have made such estimates (tables 25 and 26). 5/ Furthermore, the surveys in the Syrian Arab Republic and Samoa, two countries for which international movements are very large and important, have obtained detailed data of migrants tabulated by the main countries of origin and destination. 6/

Table 25. Estimated average annual volume of migration in Iran, 1973-1976

Category and area	Out-migrants	In-migrants	Net gain or loss
Internal migration			
Teheran	145 000	203 000	+58 000
Other urban	453 000	707 000	+254 000
Total, urban	598 000	910 000	+312,000
Rural	919,000	607,000	-312,000
Total, Iran	1 517 000	1 517 000	--
International migration			
Teheran	27 000	20 000	-7 000
Other urban	13 000	10 000	-3 000
Total, urban	40 000	30 000	-10 000
Rural	9 000	3 000	-6 000
Total, Iran	49 000	33 000	-16 000
All migration			
Teheran	172 000	223 000	+51 000
Other urban	466 000	717 000	+251 000
Total, urban	638 000	940 000	+302 000
Rural	928 000	610 000	-318 000
Total, Iran	1 566 000	1 550 000	-16 000

Source: Statistical Centre of Iran. Population Growth Survey of Iran. Second Survey Year, 1974/75 (Teheran, 1978).

Table 26. Estimated average annual volume of migration in Nepal, 1974-1978

Category and area	Out-migrants	In-migrants	Net gain or loss
Internal migration			
Mountains	31 000	21 000	-10 000
Hills	246 000	205 000	-41 000
Terai	221 000	261 000	+40 000
Urban areas	29 000	40 000	+11 000
Total, Nepal	527 000	527 000	--
International migration			
Mountains	5 000	2 000	-3 000
Hills	42 000	30 000	-12 000
Terai	21 000	9 000	-12 000
Urban areas	4 000	3 000	-1 000
Total, Nepal	72 000	44 000	-28 000
All migration			
Mountains	36 000	23 000	-13 000
Hills	288 000	235 000	-53 000
Terai	242 000	270 000	+28 000
Urban areas	33 000	43 000	+10 000
Total, Nepal	599 000	571 000	-28 000

Source: Nepal Central Bureau of Statistics. Demographic Sample Survey of Nepal. Third Year Survey, 1977/78 (Kathmandu, 1978).

There may now be reason to examine what effect migration may have on the recording of births and deaths. Since departures are replaced in the sample by arrivals, there is, in principle, no-long range effect on vital rates. However, as pointed out in chapter III, the follow-up procedure, strictly speaking, covers the migrants only from round to round and not during the open end periods. Supposing now an annual departure rate of 8 per cent, the departed persons represent 4 per cent of the actual person years in the sample, and the arrivals another 4 per cent. Since only half of this time comes under follow-up observation, a total of 4 per cent of person-years in the sample areas are not observed. Supposing further that the mortality of the migrants is only one half of the average mortality, then the survey would be observing 96 per cent of person-years but 98 per cent of deaths, resulting in a 2 per cent over-estimation of mortality. This would still be below the sampling error in even the largest surveys and also below the usual cyclical fluctuation of the death rate.

As to births, they are in many countries connected with short-term moves, and this is one reason why it is recommended that only permanent moves be recorded -- not for example, the departure of one spouse if he/she is expected to return. When this practice is followed, the major source of possible bias is eliminated. As to migrants proper, they may have a low birth rate because they include a large proportion of young unmarried persons; otherwise, an expected or recent birth of a child may affect, either positively or negatively, the decision of a family to move. It is difficult to say what effect and in which direction the follow-up rule, by limiting the observation period of migrants, has on the observation of either births or deaths in relation to person-years-at-risk. On balance, the effect is perhaps more likely to be in the direction of overestimating the rates, but since the margin within which the uncertainty operates is very narrow, the error is probably minimal and may be further reduced by adjustment of vital rates to the age distribution of the general population.

Population change

Once the data on fertility, mortality and migration have been calculated, the composite picture of overall population change emerges. This is in the first place expressed in rates, and they are of course prepared annually. In table 27 the overall results are summarized for the four countries for which they are available.

Table 27. Population change and its annual components per 1,000 population in four surveys

Rate	Iran 1973-1976	Nepal 1974-1978	Syrian Arab Republic 1976-1979	Samoa 1981/83
Crude birth rate	41.8	44.7	43.0	31.0
Crude death rate	11.5	19.6	8.2	7.4
Natural increase	30.3	25.1	34.8	23.6
Net international migration	-0.5	-1.7	-6.9	-16.7
Rate of population growth	29.8	23.4	27.9	6.9

The survey method is designed to yield rates and ratios and not necessarily to make direct estimates of either population size or volumes of change. However, the survey results -- if they are acceptable -- can and necessarily will be applied for calculation of absolute figures of change and for onward calculation of population size. This is done by applying the survey rates to the official population figures produced by census or other sources. An example is given in table 28 for Iran and Samoa.

Table 28. Volumes and components of population change in two surveys

	Iran 1973/74	Iran 1974/75	Samoa 1981-1983
Live births	1 376 000	1 387 000	4 900
Deaths	404 000	391 000	1 200
Natural increase	972 000	996 000	3 700
Net international migration	-14 000	-17 000	-2 600
Population growth	958 000	979 000	1 100

Sampling error

It is useful to calculate the sampling errors for at least the most important results of the survey, and to those belong the birth and death rates and the rate of natural increase as well as the corresponding subnational rates, if any. They will largely set the tone for the interpretation of the results, including those for subgroups in the various tabulations. For rates and ratios based on small numbers of observations, as may be the case -- e.g., with age-specific death rates -- it is useful either to indicate the number of cases or to give the sampling error.

Exact sampling errors for all values are not often calculated, since that would require extensive work, even in a computer. There may also be reluctance to burden publications with them. Instead, the reader may be advised to apply given coefficients of variation to given series of sample estimates in order to obtain approximate values of the standard error. Some approximations, however, apply only to rare events, such as births and deaths in the general population; births in a group of married women may be too frequent for similar shortcuts.

In a self-weighting sample, including cluster samples, the estimate of a vital rate is:

$$\hat{R} = \frac{\sum b}{\sum p} \qquad (4.8)$$

where b = number of events (e.g., births)

p = person-years-at-risk

The estimated variance of this rate in an unstratified sample is:

$$\hat{\sigma}^2(R) = \left[\frac{N-n}{Nnp^2} \Sigma b^2 + \frac{(\Sigma b)^2}{(\Sigma p)^2} \Sigma p^2 - 2 \frac{\Sigma b}{\Sigma p} \Sigma bp \right] \qquad (4.9)$$

where N = number of clusters in the universe
n = number of clusters in the sample
p = mean number of person-years per cluster

The square root of the variance is the standard error.

For calculations involving stratified samples, possibly with variable sampling fractions and other more complex cases, reference is made to the work of Kish and Frankel 7/ and Verma. 8/

As an example of the level of sampling errors of vital rates that can be expected for national and regional results, table 29 gives them for the Iran survey which covered the experience of 281,000 person-years-at-risk.

Table 29. National and regional vital rates with their standard errors, Iran, 1973-1976

Region	Births per 1,000 population	Deaths per 1,000 population
Total (national)	41.8 ± 0.7	11.5 ± 0.3
North and Northwest	41.5 ± 1.0	12.5 ± 0.5
Central	35.1 ± 2.0	8.4 ± 0.5
West	49.8 ± 1.3	14.9 ± 1.0
East	50.7 ± 2.0	18.1 ± 1.0
South and Southwest	45.2 ± 1.0	9.3 ± 0.7

The survey of 1973-1976 demonstrated some very striking regional differences within Iran in both fertility and mortality, and the sampling errors proved many of those differences highly significant. It can further be appreciated that the lower frequency of deaths and the probably higher cluster effect in mortality produce sampling errors which are higher relative to the estimated rates (in other words, the coefficient of variation is higher) than the sampling errors of the birth rate -- yet, in terms of 1,000 population they are lower.

Finally, it should be noted that the classical equation of sampling variance presented above in equation 4.9 actually overstates it when the sample has been selected by systematic sampling from a geographically arranged frame. This kind of selection procedure in fact achieves the effect of stratification, but the formula does not reflect the added precision reached by so doing.

Notes

1/ Iran, Statistical Centre of Iran, Population Growth Survey of Iran, Final Report, 1973-1976 (Teheran, 1978).

2/ Syrian Arab Republic, Central Bureau of Statistics, Follow-up Demographic Survey, Final Report 1976-1979 (Damascus, 1981), p. 75.

3/ Pierre Cantrelle, "Mortalité périnatale et infantile au Sénégal", in Proceedings of the International Population Conference, London, 1969, vol. II, pp. 1,032-1,042.

4/ Syrian Arab Republic, Central Bureau of Statistics, Pregnancy Follow-up Study in Syria 1976-1979 (Damascus, 1984).

5/ Iran, Statistical Centre of Iran, Population Growth Survey of Iran, Final Report, 1973-1976 (Teheran, 1978), p. 104; Nepal, Central Bureau of Statistics, The Demographic Survey of Nepal, Third Year Survey 1977/78 (Kathmandu, 1978), p. 27.

6/ Syrian Arab Republic, Central Bureau of Statistics, Follow-up Demographic Survey, Final Report 1976-1979 (Damascus, 1981) p. 112; Samoa, Department of Statistics, Vital Statistics Sample Survey Report 1983 (Apia, 1984).

7/ L. Kish and M.R. Frankel, "Inference from complex samples", Journal of the Royal Statistical Society, vol. 36 (1974), pp. 1-37.

8/ Vijay Verma, "Sample designs for the World Fertility Survey", Bulletin of the International Statistical Institute, vol. 46, No. 3 (1977).

Chapter V

COORDINATION OF THE FOLLOW-UP APPROACH IN GENERAL HOUSEHOLD SURVEY PROGRAMMES

The case for cooperation

It is clearly in the interest of the country and of the national statistical office to marshal their data collection resources in an optimal way. All resources are basically limited, most often the financial ones, and even if those are ample, two other essential commodities -- trained workers and local experience -- cannot be bought ready-made.

Lack of coordination in statistical survey activity may lead to repetition of costly and time-consuming work such as sample designing, mapping and programming. It may also lead to bottlenecks or, on the contrary, to human, machine and transportation capacity lying idle. Maximum use may not be made of branch networks or field campaigns and the usefulness of separate activities may be curtailed if their results, for minor technical reasons, do not fit together.

Full coordination, however, does not necessarily imply the launching of a mammoth multisubject national sample survey. The desire to achieve maximum economy and at the same time to provide ample possibilities for crosssectional data linkage has sometimes led to such a solution. While it is certainly possible to reconcile the requirements in sample size and design of many different subject matter fields and to design a questionnaire or a set of them to serve them all, the problems do not end there. When a given intangible limit is exceeded, the capacity of the field staff will be overtaxed, the length of the interviews will create respondent resistance, the editing of the materials may become inordinately complicated, and finally logjams may occur in data processing. It has happened that costly, large-scale national surveys have bogged down for such reasons and have had to be abandoned with little to show for the effort.

A more likely successful solution is to build up the survey capability of the national statistical office so that it can be continuously engaged in undertaking the necessary surveys at the right times and in the optimal form. This involves the creation of a well trained and adequately equipped field arm for a continuing data collection activity through sample surveys. In all but the smallest countries this means the establishment of branch offices in provinces or other major civil divisions. It does not necessarily mean placement of statistical agents far in the periphery. Certainly locally placed health personnel or agricultural extension workers may be very effective, even essential, for certain tasks because they have the necessary subject matter knowledge and are an organic part of the administrative branch in question. Statistical agents, however, who would have to collect data of many kinds, working largely in isolation, would not likely be effective in sample surveys. Temporarily recruited local persons are usually even less suitable. Instead, a small group of career interviewers

based in a viable branch office under the guidance of a professional statistician and a field survey officer (who may or may not be the same person) have often been found to be very effective.

Coordination between different surveys, when they cannot advantageously be combined, means that they should be carried out in a suitable succession, one after the other, by the same field staff who will be trained specifically for one survey at a time and who, in the periods between surveys, perform office duties, since no person can be required to be constantly touring the field. Timetables shall show, on the one hand, all the stages of a given survey from the beginning to the end and, on the other, the work programmes of the field interviewer force, the mapping unit, the data entry unit, the computer unit and other sections, indicating the periods they will be engaged in different surveys.

While good cooperation thus requires careful planning, a word of caution might be appropriate against overdoing it. It might be thought that the actual execution of sample surveys should only begin after a comprehensive, multifaceted, national sample survey programme has been approved. While this seems theoretically right, it may result in a great loss of time and will not necessarily guarantee the best final outcome, because even the most carefully constructed plan may prove to have practical flaws, particularly if it involves activities which have not been undertaken in the country before. Momentum and interest may also be lost, and so may be an opportune point of time if a smaller survey which is ready to be launched is held up, awaiting the preparation, financing and approval of a comprehensive plan. In the final analysis, survey capability depends to a large extent on experience in application. Even techniques well proven elsewhere require some amount of testing and perhaps a great deal of adaptation when introduced into another country. The logistics of a growing organization also have to be run in. This is why even minor single-subject enquiries can play a role in preparing ground for larger programmes.

Another reason against starting a very large programme at once is that it requires the recruitment of a large staff at one time. While this may not be difficult regarding field staff, at the higher and medium levels it is likely to lead to the recruitment of some not well qualified candidates. And since a sudden expansion at one time almost certainly means slow or no expansion in the following years, the result will be that even the best qualified candidates who graduate during those years will find little possibility to join the service. A recruitment programme has better chances of success if the expansion is steady and gradual, and this, of course, can be done under a unified plan.

The responsibility for sample surveys of national scale and national importance naturally lies with the Government -- just as the responsibility for censuses and civil registration does. In most countries, this responsibility is vested in the national statistical office, perhaps shared with some other governmental departments, and thus strongly centralized. Even when in a federal system the constituent states or republics have relatively wide independence in statistical work, the contents of the most important statistics are uniform throughout the country. In many instances, either the national statistical office or a

special standing committee in which the former plays a leading role has to be consulted for any important plan to collect statistical data. In some countries, governmental departments are not allowed to undertake statistical surveys without its approval. Very often, therefore, at least the ground rules are there for very thorough coordination of sample surveys.

In many countries, non-governmental initiative plays a role in complementing official statistics by collecting information, among other ways, by sample surveys. The takers of such surveys in demographic and related fields may be universities and research institutions, civil organizations, professional, business and labour associations and others. For population data, it is mainly the universities which, through their faculties or institutes of demography, statistics, sociology or public health, are interested in and capable of undertaking sample surveys. They are often small scale surveys done locally. Typically they are in-depth studies and may investigate causal relationships. Sometimes they are of an experimental nature and contribute to advances in methodology. In addition to the actual results they produce, surveys conducted by universities are an important training medium.

Non-governmental organizations can play and often do play an important role in complementing the information that public statistics provide on the demography of a country. While it is often not considered desirable to regulate their activity too much -- if at all -- thus stifling initiative and imaginative experimentation, contacts between the public and non-public sector can stimulate the work of both and guide it in many ways. National statistical offices may find it useful to arrange either official or informal contacts and coordination between workers in their field.

In the following sections the coordination of a demographic follow-up survey with other sample surveys is discussed. It is done with the understanding that the most important achievement would be coordination with other nationally important, officially sanctioned and centrally organized sample surveys such as those on household income and expenditure, labour force, migration, education, housing, agricultural production, home industries, nutrition and health and so on, some of which may be either frequent or continuous. It would be particularly useful to examine the possibility and extent of coordination with a national household survey programme encompassing any or all of these and others that the Government might wish to implement.

Three avenues of coordination are discussed below, corresponding to varying degrees of coordination:

(a) Conceptual uniformity;
(b) Operational coordination;
(c) Coordination of the samples;
(d) Substantive relationship.

Conceptual uniformity

Definitions and classifications should be as uniform as possible throughout the entire statistical system of a country. It must be recognized, however, that, owing to different points of view on the various subsystems or to weighty practical matters, full uniformity may not always be attainable. It is often very difficult even to surmount quite minor differences which are due to vicissitudes of historical development rather than inherently different needs and which bureaucratic inertia tends to perpetuate. In an undertaking such as a national household survey programme, it is most important to achieve comparability in concepts, definitions, classifications, units of analysis etc. between the different surveys.

Concerning demographic items, it is usually possible to reach a very high degree of accord between the population census, sample surveys and vital statistics within one country and even internationally. Most sample surveys, in whatever field they operate, refer in one way or another to a population; in so doing they should adhere as far as possible to the population concepts, definitions, classifications and units of analysis that are in use in demographic statistics. Internationally recommended and very widely accepted definitions and classifications of most items which are likely to be included in a demographic survey questionnaire are given in Principles and Recommendations for Population and Housing Censuses 1/ and Principles and Recommendations for a Vital Statistics System. 2/

Operational coordination

The "operational coordination" of two or more surveys is understood here to mean that each survey retains its independence as to the sample and the questionnaire but is executed in the field by the same organization. From the independence of the samples, it follows that the tabulation plans will also be independent, while the actual processing will most likely be done by the same data processing facility.

The advantages secured by this kind of cooperation will mainly be in the cost-efficiency of the operations at both data collection and data processing stages. Gains in quality will also very likely be made, because a common organization can muster greater competence and in its turn benefit from the added experience. Such gains may be felt at all stages of the work, from planning to publication.

The key question is the coordination of the field operations so that the same interviewer and supervisory staff can carry out the different surveys. How this should be arranged will depend on many factors -- among them, the sample size and design, the length of the interviews, the requirements as to timing and periodicity, the accessibility of the sample areas and the relative cost of personnel and transportation.

Assuming the employment of a permanent field staff, centralized to national or province level, it might be practical to take two or more surveys simultaneously in such a

way that the teams, once deployed in a given area, will carry out the surveys one after the other before moving into the next area. Another possibility is that the field force might complete one survey in all areas and then return to base before being trained for and embarking on the next survey. If the individual surveys involve several rounds, they would be dove-tailed into a continuous operation where the rounds of the different surveys alternate and where, between periods of field work, there would be periods of stay at the base office. These latter periods are needed for feedback of experience, assessment of work done, rest and retraining. They might include office work related or unrelated to the surveys.

It is generally cost-effective to collect many data in one place before moving to another. However, this principle must not be stretched so far that the interviewers do not fully master the subjects or that the respondents, if they are the same for the different surveys, show fatigue or resistance. It will depend on the actual geographical dispersal of the different samples whether a combined execution will result in substantial or only minor savings in travel time and cost. There are advantages to keeping different survey operations separate so that the interviewers can concentrate on one subject each time. The different phases of data processing need to be coordinated by timing the programmes of the different surveys so that a smooth flow is achieved and excessive heaping and delays avoided. Possibilities for this are usually good when the field work has also been timed.

When a comprehensive survey programme is being planned, thought should be given to the reaction of the public in face of the increased data collection activity. Interview fatigue has certainly been very much overestimated and feared. If common sense is exercised in setting up the survey programme, the respondents are likely to cooperate. In demographic follow-up surveys, when the intervals between visits are as long as six months, when the interviews are not excessively long and the questions themselves neither objectionable nor suspicious, no evidence has been produced anywhere of rising respondent resistance.

A more serious matter than respondent fatigue is initial resistance. Enquiries are often met in the field with caution, reserve and suspicion, if not outright refusal. In a multiround programme, it is the first round which bears the brunt of this handicap, and single round surveys naturally never benefit from the gradually relaxing cautiousness. Integrated surveys stand to share the favorable reception unless they are too heavily concentrated in any given area.

Coordination of the samples

Advantages and limits of coordination

A national household survey programme offers extensive possibilities for the coordination of the sampling aspects of the different surveys. Such coordination may be carried to various lengths; the following degrees of integration may be distinguished:

(a) Use of common sampling arrangements, principally a common frame, common cartography and other related information;

(b) Use of a common master sample of areas from which different subsamples can be selected;

(c) Use of common sample areas, which may either be covered exhaustively or from which different household samples may be selected;

(d) Use of a common sample of households.

Since a demographic follow-up survey normally covers minor areas exhaustively, the last alternative above concerns only those other surveys that would be coordinated with it.

The possibilities for close coordination of sampling depend mainly on the intrinsic requirements or preferences of the different surveys as to what kind of samples they should have: the target population, sample size, clustering, stratification etc. and, in repeated surveys, periodicity and rotation. Reconciling the different points of view may be a complex task and not always feasible, but some compromises may be worthwhile in order to gain the benefits of a greater degree of coordination.

Coordination will yield benefits, first of all, in the preparation of the frame and in cartography. As those tasks are likely to require extensive field work in preparing or checking and updating the frame and in drawing or updating maps, the savings may be very substantial both in expenditure and in time. Linkage and overlap between surveys may be organized if they are using a common master sample.

Operationally, savings in travel time and transportation cost can be expected when the interviews are conducted at fewer points. At the same time the field staff will become more familiar with the sample areas, local administrators and the sample population. This often leads to improved confidence and better acceptance of the surveys by the respondents.

Concentration of data collection to fewer points may also have adverse effects. The most serious is the possibility of respondent resistance or fatigue developing when the interviews become longer or more frequent. There is no global norm that would help survey planners in this respect: the experience around the world varies too much for that. In developing countries, as a general rule, once the first contacts have been successfully made and the cooperation of the people secured, long interviews are slower to create resistance in villages than in cities and, quite often, are less of a problem than has been feared. Care should naturally be taken not to prevent people from attending to their pressing chores.

It has been often found that a survey, when accepted in a given community, paves the way for another survey. Inversely, a problem with one survey may harm others. Distrust raised by a sensitive question has sometimes had far-reaching consequences. The

acceptability of a question cannot always be judged a priori, and questionnaire tests can be used for finding out in advance what can be expected to happen at the actual interviews.

Intensive and prolonged surveying in the same areas may have a conditioning effect: the sample areas or households may lose their representative character because of the survey activity. This is more likely to affect answers to questions on knowledge and attitudes than to questions on concrete, facts but some of the latter may also be influenced over time. On the other hand, the concentration of various surveys in the same areas or even in the same households makes it possible to carry out more than one survey in a single field operation and thus reduces the costs. There are limits, however, to how far such integration can be taken. The length of the interviews should not strain the respondent's good will, and the capacity of the interviewer to master his task should not be overtaxed.

Even when the staff has no difficulty learning the instructions properly, an imbalance in outlook to them may develop if, for example, a survey with a longer questionnaire and more complicated instructions receives more emphasis in training and supervision: it may be perceived by the staff as more important than a more straightforward survey. 3/ Although this type of problem should not make integration undesirable, it needs to be taken seriously into consideration.

Some surveys require specialized knowledge in the subject matter in question and can only be performed by special investigators. In such cases it may be advantageous to carry out one survey jointly with another one. The same transportation may be used, and the presence of an interviewer who is already known may help a new interviewer to receive cooperation.

As is seen, there are many non-sampling considerations which may exert an influence on the question of whether the samples of the different surveys should be unified or coordinated, and to what extent. Reference is made to a recent study of non-sampling errors in household surveys. 4/ The decision will depend on the particular sampling requirements of the various surveys and whether, when they differ, satisfactory compromises can be worked out.

Sample size and design

It has been shown (see chap. II) that the effective conduct of a demographic follow-up survey sets certain requirements as to the size and design of the sample. The overall size should not be smaller than about 40,000 persons, although if results are not required in less than two years, the size can be halved. The sample should be composed of compact clusters -- i.e., minor geographical areas that can be clearly delineated. The number of such clusters should not be much smaller than 100 or more than 200 for a total size of 40,000; for a larger overall size, the number of clusters may be increased. The question now is: how can these requirements be reconciled with the needs of other surveys?

Many of the surveys that come into question are truly household surveys in the sense that the ultimate sampling unit is a household (or a housing unit). Many other surveys are interested in individuals -- either randomly selected persons or persons with given characteristics. In either case, the selection is usually made through a household, although it may be done directly from a comprehensive list of individuals which may be arranged by household or in some other manner. These methods of selection do not preclude coordination with a cluster sample.

As long as the sample design is multistage and one of the stages -- usually the penultimate -- corresponds to a geographical unit that can serve as the cluster for the follow-up survey, there is, in principle, a very good possibility of coordinating the samples. However, a survey which applies to households or individuals that are selected directly from a national, provincial or municipal frame cannot be usefully coordinated with a follow-up survey. Such cases, however, have not been very common.

Undoubtedly, most sample surveys use samples of households or individuals rather than area units. This is a very essential requirement when the interview is relatively long, a large amount of data is collected at each interview, and the intra-cluster correlation is high -- that is the households or persons in one cluster resemble each other much more than they resemble those in other clusters. It has been found that with a constant overall size and a cluster size of a few hundred persons, the intra-cluster correlation raises the standard errors of birth and death rates in an order of magnitude of approximately 50 per cent. This is a very light effect compared with what may happen with many other study objectives. If a survey is searching for cases which are relatively rare, such as handicapped persons or persons of a given age, mothers with a large number of children etc., it can also use cluster sampling with good effect because the method covers in a short time a large population in which the target persons can be identified. In most cases, however, cost-effective sampling requires selection of households or individuals.

In such cases then, the ultimate samples have to be different from those of a follow-up survey. But since household samples are commonly multistage samples, it may be feasible to select first, at one or more stages, an area sample which will serve the follow-up survey as such and then in one more stage, a household or individual sample for the other survey.

The question is first of all of the ultimate size. As an illustrative example, it is quite common in a household survey for at least five households to be selected in each penultimate unit. These will thus form loose clusters. If the follow-up survey is composed of 200 clusters, it will yield conveniently at least 1,000 households (or 1,000 individuals) for the other survey. If these are too many, the survey in question will be limited either to fewer clusters or to fewer units per cluster, according to its particular requirements. If, on the other hand, the size is too small and the number of clusters multiplied by the maximum acceptable number of units per cluster results in too small an overall size, obviously a larger number of clusters is needed.

In this latter case, the household survey determines the number of penultimate units that have to be selected and prepared for last-stage selection: a kind of master sample. There would now be reason to consider whether this fact would make it worthwhile to increase the demographic sample also, since many of the initial expenses will now be borne anyway. Likewise, the sampling options of any other survey will be increased. If the decisions regarding these options are negative, the follow-up sample will use only a part of the selected area units while a third survey might make use of an even smaller part of it.

Whether the samples selected for the different surveys cover each other fully or only partly, considerable savings can be expected. Generally speaking, the largest sample determines the cost of the frame preparation, including listing and mapping, while the smaller applications are derived from it at low additional cost.

In household surveys at the last stage, a fixed number of households is frequently selected for the sample. An equal number of households to be covered in each area makes the field programme more equitable and easier to plan, and it also offers advantages in the calculation of results. Certain analytical methods are based on a fixed number of units in each loose cluster. However, a fixed number of units at the last stage requires sampling with probability proportional to size at the earlier stages -- otherwise, the sample would not be self-weighting. Contrary to this, a survey which covers the last stage units exhaustively, regardless of size, requires sampling with equal probability at the earlier stages.

A way out of this dilemma of conflicting needs is offered by segmentation, which means subdivision of the area units into smaller ones in order to achieve a rough uniformity in size. When this is successfully done, all sampling between them can be done with equal probability even if a fixed number of households is selected from each of them. For practical purposes it is sufficient to achieve only approximate uniformity of size.

It is not necessary to proceed with the actual segmentation before the selection of the sample. What has to be done before selection is to determine which units need to be divided and into how many segments and then to give all segments an equal chance in the selection. Only when the selection falls on a unit which has to be segmented will the actual division be done on the map or in the field and one of the segments elected with equal probability.

Stratification

The view was presented in chapter III that a demographic follow-up survey does not usually benefit much from extensive stratification. Because its main purpose is to replace or improve on existing vital statistics, it is directed primarily towards national results, secondly to those for the urban and rural sectors and thirdly, if the size can be sufficiently extended, to subnational regions. These aims are, generally speaking, best served by sample design determined by population size. Since for the objectives in mind every person is of equal importance, each person in the population should stand an equal chance of being included. The sampling fraction would then be uniform and the sample fully self-weighting. This

lessens, though does not eliminate, the case for stratification.

Most of the surveys reviewed in this report have indeed been self-weighting. One exception was the Nepal survey which had four strata, each with a different sampling fraction. There were mainly two reasons for this. On one hand, the urban stratum in Nepal is so small that it would not yield valid estimates unless it were more intensively represented. On the other hand, the sample in the mountain stratum had to be limited because of the excessive cost and difficulties it would otherwise have caused. It deserves mention that, for the same reason, areas of very difficult access but small populations have been entirely left out of many of the national surveys.

It is often said that stratification can do no harm even if it should fail to do any good. Therefore, the particular stratification requirements of the other surveys, whatever they may be, will not harm the demographic follow-up survey. The rural demographic survey of Nigeria in 1965/66 was attached to an ongoing agricultural survey for the simple reason that a network of agents was already in place in the sample villages. The agricultural stratification on which the sample was based was considered probably irrelevant, but harmless, for the demographic survey. When, in addition, the sample population was found to be apparently representative of the general rural population, it was thought unnecessary even to weight the data.

Duration and periodicity

It was suggested that the minimum duration of a demographic follow-up survey should be 12 months (chap. II), while better results in a more cost-effective way can be expected if the survey is continued for one or more additional 12-month periods. For the estimation of infant mortality from pregnancy follow-up, 24 months is the minimum, but additional 12-month periods will bring greater precision. In principle, the longer the longitudinal study, the better.

Many countries have sample surveys which continue indefinitely, and there is a tendency for them to increase in number as they gradually become more perfected and prove their usefulness. Among them are demographic surveys and others which collect a few population data, among other subjects. It is quite feasible to carry out a demographic follow-up survey in a continuous manner. In such a case it is important to update the frame from time to time -- at least after each population census.

Again, many objectives are well served by single-round surveys which may be repeated either in the same or a different form after some time has passed. There is a very good possibility of carrying out a number of such enquiries in connection with the different rounds of a follow-up survey, each with its own questionnaire and perhaps each on a different subsample. There is an obvious advantage in trusting this task to the follow-up interviewers. If this is not possible, because of the specialized knowledge required, it would still be advisable to carry them out concurrently, because the presence of the follow-up interviewers

who are already known to the people helps other interviewers obtain the cooperation of the residents.

It can be concluded that the varying durations of the different surveys are in no way an obstacle to their coordination. What is necessary is establishing a realistic operations calendar for their execution.

Surveys may have quite definite requirements as to when they should be carried out, certain seasons being quite unsuitable for a given enquiry. Agricultural surveys are naturally among them and may claim a certain priority as to their optimal timing. Certain others should be spread over different seasons, and there may be user pressure to collect more and more data monthly.

The timing needs of a demographic survey are not very compelling. However, times of heavy seasonal movements and major festivals and pilgrimages should be avoided, when possible, and natural conditions may be more or less serious obstacles to field travel in certain seasons. Some leeway is provided by the flexibility possible regarding the dates of the intermediate rounds, which can, without harm, deviate somewhat from the ideal six-month intervals. Once the timing requirements of the different surveys have been charted, a suitable operations timetable should be drawn up, joining the field visits of the different surveys when that offers an advantage.

Rotation of the sample

Many multiround and continuous surveys make use of rotation, one reason being that it increases the overall size of the sample. This means that at determined times, such as at each round or each year, a part of the sample or even the entire sample is replaced by another one. If each time one $\underline{n}^{th}$ part of the sample is replaced, for example, then after $\underline{n}$ rounds the sample will have been completely renewed. The sample may thereafter continue being replaced by new elements, or the rotation may return to earlier subsamples in a cyclical movement. Rotation can be an economical way to combine a relatively large overall sample size with information on change, both seasonal and of longer term. The change from one round or one year to another may be determined either by aggregates or individually.

As has been repeatedly demonstrated above, follow-up requires continuity, and the idea of rotation is contrary to it. Rotation is also costly, since it requires new sampling, mapping and a baseline survey. If the two opposing needs are to be served by a common sample, a compromise is required. Since a too rapid and sweeping replacement would entirely destroy any attempt at individual follow-up, it is necessary to try to find a measured tempo of rotation or a particular type of rotation which would satisfy the minimum needs of the follow-up. However, there are some rotation schemes which would not affect the follow-up at all. If, for example, the rotation takes place between households in the master sample, either by moving within each area unit or from one area unit to another, there will be no conflict. Also, if the rotation is monthly or quarterly and returns to the same areas at six-

month intervals, there will be no problem. However, this may not always serve the purposes of the other survey in question.

If the rotation is non-recurrent and widely spread out geographically, a fully integrated sample can serve both objectives only if the duration requirements of the follow-up are met. Each area unit should then remain in the sample for at least one year for general follow-up and for two years if pregnancy follow-up is in the programme. Longer durations would naturally be preferable. If a compromise along these lines is not feasible, there is still the possibility of partial integration of the two samples, one gradually moving away from the other. Depending on the geographical proximity of the separate samples, this may not cause very great inconvenience, and the savings in cost may still be substantial. In some situation, rotation for other surveys may be confined to areas outside the sample for the follow-up survey. This latter may itself benefit from some rotation if the objective is to cumulate data for greater geographical breakdown.

Substantive relationships

In the context of a continuing programme of household surveys, attention needs to be paid to the relationship between subject matter coverage of different surveys. Clearly the total data requirements of the programme have to be grouped into manageable, separate surveys in a manner which is most economical, operationally convenient and conducive to linkages between data of various types. The disadvantages of trying to cover too many topics in a single mammoth multisubject survey have been noted. Nevertheless, the occasion of one survey may often be conveniently used to collect some data on other topics, insofar as the subjects put together are mutually compatible as regards substantive content, sampling and other operational requirements and do not adversely affect the quality of each other or result in unacceptable respondent and/or interview burden.

In relation to follow-up demographic surveys, the relatively large sample size and the updating of the population covered within sample areas in each round can provide a good opportunity to collect a limited amount of additional data on some related topics, whether over the whole sample or over a subsample of households. This applies in particular to the base-line survey. Information on basic demographic characteristics defines the population covered and provides a framework within which data obtained in other surveys can be placed. It can also provide the basic information required for stratification, subsampling and estimation and also help to identify rare elements or individuals with specified characteristics -- i.e., for screening or double-sampling arrangements for other smaller-scale surveys. Furthermore, population characteristics enumerated in the demographic survey give denominators for computing rates and ratios and common categories for classifying and tabulating data from different surveys.

Another possibility in a household survey programme is to achieve linkage between surveys through a set of core items which are repeated from one survey round to another.

The use of core items permits continuous monitoring of time trends on selected topics. They can also provide common criteria for classification of results and common bases for estimation for different surveys.

These and other potential results of using the demographic survey as an instrument of substantive integration should be kept in view in planning the survey. At the same time, of course, overloading of any surveys must be avoided, and the content of any large scale in particular must be kept as simple as possible.

Notes

1/ Principles and Recommendations for Population and Housing Censuses (United Nations publication, Sales No. 80.XVII.8).

2/ Principles and Recommendations for a Vital Statistics System (United Nations publication, Sales No. 73.XVII.9).

3/ Methodology of Demographic Sample Surveys (United Nations publication, Sales No. 71.XVII.II), para. 41; ORSTROM and others, Les enquêtes démographiques à passages répétés. Application à l'Afrique d'expression française et à Madagascar (Paris, Office de la recherche scientific et technique d'outre-mer, 1971), p. 115.

4/ United Nations, National Household Survey Capability Programme, "Non-sampling errors in household surveys: sources, assessment and control" DP/UN/INT-81-041/2).

Chapter VI

CONCLUSION

The follow-up method of collecting data on population change and its components -- fertility, mortality and migration -- has been used since the late 1950s in a number of developing countries on all continents. In a new series of surveys starting in 1973, which are described in the present report, the method has been further developed through the introduction of systematic quality checking and recording the follow-up of pregnancies. At the same time the concepts and procedures have been crystallized on the basis of earlier experience into a set of guidelines and applied in a number of national surveys.

Two overriding concerns in the methodology applied in these surveys have been clarity and simplicity. The method leans to the maximum extent on verifiable facts and places minimum reliance on the willingness of respondents to volunteer information or on their ability to remember dates. With its clear definitions, simple and straightforward questions, careful checking, including quality control, and the possibility to correct earlier information, the method endeavours to produce data on current population change which are precise and as complete as possible.

In the recording of births and deaths, the method has reached very high levels of completeness, and the residue has been measured through quality checks, thus permitting a commensurate adjustment to be made. Infant mortality has been estimated through pregnancy follow-up more precisely than by earlier survey methods, and the procedure has been extended to cover pregnancy wastage also. It has further been shown that migration, when understood as changes of usual residence and not as short-term moves, can by this method be very accurately measured in terms of its volume and the previously recorded characteristics of the migrants.

The method does not place unduly heavy demands on high-level trained personnel because the procedural rules, data processing and interpretation of results are quite straightforward and leave little room for subjective judgement. The staffing needs may best be discussed in relation to a size and type that can be referred to as a basic example -- i.e., a survey which covers a sample of 40,000 persons in about 100 area units, such as census enumeration areas. The areas are canvassed twice a year over a few years, and once a year a quality check is carried out by reinterviewing a subsample of households. The results are processed annually. For this basic example, the staff requirements are approximately 118-148 worker-months per year, not counting data processing.

Extending the survey for a longer time -- e.g., an entire intercensal period or indefinitely -- is a distinct possibility. The periodic return of the same interviewers to the same sample areas has been observed to overcome any resistance or reserve on the part of the population that may have been met with. After a certain length of time, such as an

intercensal period, it is nevertheless recommended that an entirely new sample be selected.

With its periodic cycles, the follow-up survey does not require full-time around-the-year staff and can be dovetailed with other data collection activities, whether single-round or recurrent. It is thus well suited to be coordinated with general household survey programmes. It may constitute the core for an integrated programme and be applied to a master sample of small areas from which special samples can be selected for the other surveys.

The follow-up approach does not completely replace the retrospective approach because, first, it does not produce any information at all on the past. Secondly, many demographic and social facts do not require close follow-up. Furthermore, in situations where no valid information at all is available on demographic parameters, it may be preferable to carry out, first, a single-round survey which yields results faster or to collect the necessary data in a population census. Some countries may lack even the very basic capability for conducting a multiround operation. However, if a country has roughly estimated its demographic situation by means of census questions or a retrospective survey and then wants more precise and up-to-date information, a follow-up survey may be the appropriate choice. And it may, again, include some retrospective questions in its first round.

While the method offers the possibility of reliably measuring current fertility, mortality and migration in a well-defined timeframe, it should be realized that no data collection operation will ever succeed by virtue of the method alone. There must be competent and attentive leadership and a reasonable, smoothly functioning field arm with a trained and motivated (though small) interviewer staff. The importance of good training, high staff morale and close supervision cannot be too much emphasized.

In comparison with the alternative methods of data collection, the follow-up method offers the following advantages:

(a) Any memory lapse on the part of respondents is effectively controlled, since the interview is conducted with reference to an earlier record and covers a limited time span;

(b) The respondent cannot avoid mentioning the death of a previously listed person; recording of mortality is thereby decisively improved;

(c) Pregnancy follow-up assures a virtually complete recording of neonatal deaths -- the element most incompletely recorded by other methods. An early death may still be misstated as late foetal death, but it will not simply be omitted;

(d) Migration data are very much improved since both departures and arrivals are recorded. Out-migrant data are found to be consistently more complete than in-migrant data; single round surveys rely entirely on the latter;

(e) Timing problems, including the "border effect," are virtually eliminated since

events can almost always be placed into the correct time interval between rounds;

(f) Rigorous correspondence is maintained between vital events and the base population;

(g) The completeness of event recording can be measured, and correction factors provided by means of quality checking. Earlier errors can be corrected on later occasions. Certain rules against backdating, however, have to be observed;

(h) Repeat visits enable the survey staff to know the areas better and, as is widely reported, greatly improve the cooperation of the public;

(i) With its well-defined time periods, the method throws light on annual fluctuations and overcomes the bias they may contribute to some indirect techniques;

(j) Subnational data, such as urban/rural and regional data, are not impaired by past migration, as is the case in retrospective methods.

The following drawbacks should be weighed against the advantages:

(a) Higher cost. Other things being equal, the method is more costly than a one-round retrospective survey. Additional survey rounds entail additional expense, even though much smaller loss than the usually heavy initial outlay for launching any survey in the field;

(b) Smaller volume. A semi-annual follow-up round covers one half person-year of observation per member of the interviewed household; a retrospective interview with a 12-month reference period covers twice as much, and a question on a woman's lifetime fertility history or a person's migration history is much more cost-efficient in terms of person-years of observation or of cost per recorded event; the rigor of "observation", however, is obviously not comparable;

(c) Longer time. While the data of a retrospective enquiry are ready for immediate processing, a follow-up survey needs to operate a full 12-month cycle in order to produce data free from seasonal variation;

(d) The observation of recent in- and out-migrants in the open-end periods is not as secure as that of the rest of the sample population. In some surveys, this element has therefore been excluded, causing it, however, to be underrepresented in the sample;

(e) An obsolete frame will affect the results, particularly concerning in-migrants. The same applies to retrospective sample surveys and, to a lesser degree, to dual source systems, but usually not at all to population censuses with their effectively complete area coverage;

(f) The data are vulnerable to response errors, which are particularly liable to occur in

proxy answers. The same applies even more to single-round enquiries.

It must also be noted that unless there is systematic control of survey quality, the completeness of the results cannot be measured and the performance of the field staff may fall. Also, unless pregnancies are recorded and followed through on, early deaths are easily omitted.

Every survey approach has certain characteristics and can serve certain specific purposes that others cannot. The usefulness of the follow-up approach merits further exploration.

Annex

DEVELOPMENT OF THE FOLLOW-UP METHOD FOR MEASURING POPULATION CHANGE

First experiments

The principle of the individual follow-up of persons by repeated observations has been long applied in human sciences such as medical statistics. The idea of applying the same technique to demography arose quite independently and almost simultaneously in Asia, Africa and Latin America. Moreover, in both Asia and Africa, it was started in more than one country without the knowledge of the others.

The first surveys were experimental and localized: a purposively selected administrative area was covered exhaustively and very intensively. In Guinea, three cantons with a combined population of 32,835 were canvassed by three enumerators who made 10- 12 visits from August 1955 to July 1956. They recorded 1,622 live births and 875 deaths in the population, giving the corresponding vital rates of 50 and 27 per 1,000. A general rural sample survey with a retrospective questionnaire had previously yielded vital rates of 63 and 41, respectively, which were considered gross overestimations due to "telescoping" of reported events (Théodore and Blanc, 1961). The survey of 1955/56 was nevertheless considered only half successful (ORSTOM, 1971).

In 1956, as part of the Rural Study of Population Control in India, a field trial was started in Singur, the practice field of the All-India Institute of Hygiene and Public Health, Calcutta. In order to obtain accurate vital statistics, every household was visited regularly at an interval of about three months and information was obtained in regard to births, deaths, marriages and migration which had occurred between visits (El-Badry and Chandrasekaran, 1961). Other studies of the same type were made at about 1960 in North Cameroon and Gabon (Théodore and Blanc, 1961).

Without knowledge of those activities, national-scale surveys by the follow-up method were carried out in Cambodia in 1958/59 and in Morocco in 1961-1963; a small-scale experiment was undertaken in Guanabara, Brazil, in 1961; and longer lasting subnational surveys were started in 1962 in Senegal. These surveys are discussed below.

Having come into being without knowledge of each other, the surveys differed in procedures, but there were basic similarities and parallels, even in the details. In all of the surveys, the main -- if not the only -- objective was either to estimate vital statistics data for countries or other major areas or to develop techniques which could be used to do so. During the following decades, when experiences have been exchanged and become common knowledge, the main objective remained the same. In addition to fertility and mortality, migration soon became an almost ubiquitous subject, but concerns outside those areas have

varied from case to case.

Surveys in Asia

The first application of the follow-up method for estimating vital rates on a national scale -- though exclusive of cities -- was the rural demographic survey of Cambodia (then known as Democratic Kampuchea) in 1958/59. Before that time, no population census or major statistical survey had been taken in the country. In April 1958, every third village was enumerated on a census-type questionnaire in order to provide data on demography, educational level and the economic activities of the population. One year later a one-in-10 subsample of the same villages was made, using the filled-in 1958 questionnaires and marking on them against the name of each person whether he/she was still living in the village or had died or moved out. Women of child-bearing age were asked whether they had given birth to a child since the previous survey and whether the child was still living. In-migrants were not recorded.

The training in the 14 provincial capitals of the about 400 teachers who took part in the survey was very short and the field supervision was perfunctory. At the editing stage, the data for 15 out of the 345 villages were rejected due to obvious gross incompleteness, arising either from misunderstanding of the task or negligence. The summary data for the 330 accepted villages were as follows:

Living in the village	85,941
Dead	1,390
Departed from the village	3,432
No information given	85
Newborn, still living	3,248
Newborn who had died	178
Total	94,274

Closer examination of the data still showed evident incompleteness in the reporting of births and particularly of children who had died. After adjustments, which were probably overcautious, the main results were:

Crude birth rate	41.4 per 1,000 population
Crude death rate	19.7 " " "
Infant death rate	127 " " live births
Out-migration rate	38 " " population

Age-specific fertility and mortality and an abridged life table were calculated, and for each province crude vital rates were given and a rough assumption of migration was made.

In Indonesia, the post-enumeration survey of the 1961 population census was used as a baseline for a follow-up survey 12 months later (Kannisto, 1963). The sample was composed

of 440 census enumeration areas, selected by two-stage sampling in four strata but excluding the rural areas of the outer islands because of almost insuperable transportation and communications difficulties at the time when the census operations were being terminated. A total of 226,886 persons were enumerated and revisited one year later. The method was the same as in Cambodia except that in-migrants were also recorded.

In spite of the wide differences between the two countries and peoples, the experiences of the two surveys were largely similar. It was easy to identify pre-listed persons one year later and to ascertain their whereabouts. In Cambodia and in the rural stratum of Indonesia, the proportion of persons on whom no information was obtained was 0.1 per cent, and in the large cities of Java, it rose to 0.8 per cent.

The data on newborn children, however, pointed to underrecording, more serious in rural than in urban areas. Regarding newborn children who had already died, the data were poor, particularly in Indonesia. In Cambodia, of all recorded live-born children, 5.2 per cent had been reported to have died in the same period, and that was estimated to be only one half of the true percentage. In Indonesia, the corresponding figure was 2.6 per cent which, even allowing for somewhat lower infant mortality there, is indicative of very incomplete recording of such cases.

In both the Cambodian and Indonesian surveys, temporary local personnel were employed as interviewers. It has often been found, that that arrangement is not good for recording current births and deaths through interviews. The recruitment and training of large numbers of persons who inevitably find the job very easy -- easier than it really is -- together with the difficulties of properly supervising a large simultaneous operation and the virtual absence of means to reward good performance or to deter negligence leave room for weaknesses which will almost inevitably appear in some parts of the organization. Whether the interviewers will always conscientiously ask about newborn children and in-migrants depends to a great extent on how vigorously the matter has been stressed during the training. It was reported that, in fact, the training which was done in Indonesia at three successive stages was faulty in this respect (Kannisto, 1963). The 12-month interval observed in the two surveys is now generally considered too long for good coverage of events.

In the 1970s the following three nationwide surveys were carried out, applying the general example which forms the main subject of the present report:

(a) Population Growth Survey of Iran, 1973-1976, by the Statistical Centre of Iran;

(b) Demographic Sample Survey of Nepal, 1974-1978, by the Central Bureau of Statistics, Nepal;

(c) Follow-up Demographic Survey of the Syrian Arab Republic, by the Central Bureau of Statistics of that country.

These three surveys, as well as the ongoing Vital Statistics Survey of Samoa 1981-1985 by the Department of Statistics of Samoa, have been described and discussed in this report.

The Multi-round Demographic Survey of 1980/81 in Cyprus applied, in part, the follow-up technique, though with some distinctly different and more complex features. Instead of the usual area sample, a sample of dwellings was selected from a list of electricity metres. For one part of the sample, the follow-up period was 12 months; for another part, six months.

The Demographic Survey of Sabah and Sarawak in 1981-1983 had as its objectives the estimation of vital rates and of annual population data in those two states of Eastern Malaysia, where civil registration had remained incomplete. The survey applied the same technique as that used in Iran, Nepal and the Syrian Arab Republic, and included the follow-up of recorded pregnancies.

Surveys in Africa

In Africa the application of the follow-up method in the estimation of vital rates began in 1961 with the multipurpose survey of rural Morocco (Sabagh and Scott, 1965, 1967). The subjects were demography, agriculture, employment and housing. The first round, taken between December 1961 and February 1962, covered a sample of 741 area units with a total population of 329,960, drawn on the basis of the 1960 population census. The first round included both census-type and retrospective questions. In the second round, in May-July 1962, which covered a subsample of 149 areas and 63,666 persons, the interviewers were given only a list of household heads and were to enumerate the population independently without reference to the first-round document. There were also separate questionnaires about age and about deaths in the household. The questionnaires were matched in the office with the first round data, and a form was filled in for every conflicting case. This procedure was called "blind follow-up", and its purpose was to deny the easy possibility simply to record no change. In the third round, which was taken 12 months after the first, the interviewers held the first round questionnaires on which they had to mark the current status of each person while also resolving all conflicting cases.

The Morocco survey was conceived and planned with a view to preserving a certain independence between rounds, while also taking advantage of the longitudinal nature of the study. The real problems emerged with the collation of the data, which proved laborious and not very successful: in 10 per cent of the area units, more than 15 per cent of the population could not be matched, while in the remaining 90 per cent of the areas, the unmatched remainder was on the average 5.3 per cent -- or more than six times -- as high as the highest proportion of unidentified persons in the Indonesian survey. While the blind follow-up thus proved disappointing, the non-blind follow-up at the third round yielded plausible results: a crude birth rate of 44.8 and a death rate of 21.0 per 1,000. The Morocco experiment had demonstrated simultaneously the feasibility of the follow-up method when the base record is used as reference and the great practical difficulties likely to be encountered when no

reference is given. The procedure of "blind follow-up" has not been emulated in later large-scale surveys.

The very significant French contribution to the development of the follow-up method in Africa started in 1962 in Senegal where the Office de la recherche scientifique et technique d'outre-mer (ORSTOM) assisted the Direction de la statistique in carrying out at first local and, later, national surveys. The earliest and best known is the survey in Sine-Saloum which has been particularly important from the methodological and training point of view. This and a large number of other demographic follow-up surveys in French-speaking African countries have been described by ORSTOM (1971), INED (1977), Cantrelle (1965, 1966, 1969, 1974), Gendreau (1969, 1973, 1975) and others.

The survey in Sine-Saloum covered, in the beginning, two purposively selected administrative areas with a total population of 54,000 but was from 1966 onwards reduced to a total of 9,300 people. The methodology also underwent changes towards greater simplicity. At the baseline survey, in addition to residents, temporary visitors were also enumerated, but this practice was later abandoned when varying degrees of underenumeration of visitors were found, depending on the interviewer. During the first year, a controller visited each village every three months and copied births and deaths from so-called village books. But when the inscriptions in those books were found to be very incomplete, the recording visits were discontinued. From then on, only two interviewer rounds were made each year. During these visits, previously recorded persons were classified as living in the village, dead or moved out, while new persons were recorded owing to birth, arrival or earlier omission. In a general way, the methodology was developing in the same direction as in the surveys carried out with United Nations assistance. An innovative feature was that during the years 1965-1968 a total of 1,690 pregnancies were recorded and their outcome ascertained at subsequent visits.

While the survey in Sine-Saloum has continued in reduced scale for a long period, two other small-scale studies were carried out in Senegal in the mid 1960s with emphasis on the effect of health conditions on child mortality and including questions on employment and education (ORSTOM, 1971).

The experience of these operations was used for organizing in Senegal a nationwide demographic survey in 1970/71, covering a population of 120,000 in 277 clusters. The survey comprised three rounds at six-month intervals and, thus, an observation period of one full year. In addition to the follow-up questionnaire, a socio-economic enquiry was carried out at the second round and a housing survey at the third round. The executing organization was composed of two Senegalese and four foreign statisticians, 10 supervisors and 30 interviewers.

In this survey a comparison between the retrospective and the follow-up method was made possible, because the numbers of births and deaths in the households during the preceding 12 months were recorded at the first round. The comparison demonstrated a serious deficiency in the retrospective data (Senegal, 1973).

In the 1960s several local and regional demographic surveys were taken in French-speaking African countries, applying the follow-up technique, often combined with census-type or retrospective enquiries. Among them were surveys in the cities of Abidjan (1963/64) and Yaoundé (1964/65), taken with French financial and technical support; a survey in Kinshasa (1969/70), and mainly rural surveys in two cantons in Adamawa, Cameroon (1966-1968) and one commune and one sub-prefecture in Madagascar (1967/68 and 1969-1971 respectively). With the exception of the Kinshasa survey, which covered only 4,000 people, these were of medium size and included populations between 15,000 and 35,000. Some of the surveys covered purposively selected areas exhaustively instead of samples (ORSTOM, 1971).

There was considerable experimentation in these surveys with some special procedures. The surveys in Abidjan and Yaoundé which, again, were conceived independently of each other, were among the first to focus on migration. Both of them used 1/5 area samples but canvassed them at different frequencies. It is interesting to note that both of them were able to record a reportedly quite precise out-migration rate which in Abidjan was 7.4 and in Yaoundé 8.2 per cent a year (Roussel et al., 1968). In Adamawa, as in Sine-Saloum, books (cahiers du village) were kept in each village for recording births, deaths, marriages and migration. These were checked at the time of the survey rounds and -- although not complete -- proved useful except for migration, which was very poorly recorded. The same procedure was applied in Madagascar where, however, the recording of marriages and divorces was unsuccessful. In Madagascar pregnancies were recorded for the purpose of improving the recording of births but were not used for child follow-up.

Variants of the method were the surveys in Banya, Cameroon (Hurault, 1969), and in Burkina Faso (Quesnel and Vaugelade, 1973), in which existing census or survey records were used for a follow-up more than 10 years later.

Towards the end of the decade, three more national-scale sample surveys, in addition to the one in Senegal, were carried out in the region -- namely, in Tunisia (1968/69), Algeria (1969/70) and Burundi (1970/71).

The objectives of the survey in Tunisia (Tunisia, 1967; ORSTOM, 1971) were to provide accurate measurements of natality and mortality for the determination of population growth, to estimate the completeness of civil registration and to construct a life table. The sample chosen for the purpose was quite large -- 2.8 per cent of the national population, or a total of 140,000. It was not an area sample but rather a two-stage sample of households, the first stage being sheikdoms. This design created considerable problems in the execution, because it proved difficult to identify all sample households during the follow-up visits.

The Tunisian survey consisted of a baseline listing and two follow-up rounds, six months apart and, in addition, an exhaustive single-round survey in two sheikdoms (population 5,200) and a survey on the motivation to register vital events (Vallin, 1971). At the follow-up rounds the interviewers had in hand the earlier records of the households but

nevertheless began the interviews by enumerating the household members according to information then given and only afterwards consulting the earlier record and asking questions regarding discrepancies. The age of each person was also asked independently at each visit, and the three replies were used for the final determination of age. The field work was carried out by 70 members of the statistical service who had participated in the population census of 1966.

In Algeria, the objectives of the national survey (Algeria, 1970; ORSTOM, 1971) were to estimate natality, mortality and migration and to collect data on economic activity. Based on the 1966 population census, the sample was an area sample selected in two stages from seven strata which reflected varying degrees of urbanization and population density. With a total size of 350,000, this was one of the largest of all demographic follow-up surveys on record, the main reason for the large size being the desire to construct an accurate life table.

The Algerian survey was also done in three rounds, with six-month intervals between successive visits to each area, but the operations of each round were extended over a five-month period. The staff was thus almost continuously in the field for 18 months, a length of time which reportedly tired the interviewers and made them less conscientious. The intention was to adhere to exact six-month recall periods, and the staff was instructed to record only the events that occurred between the exact target dates, even if the interview happened later. This rule, however, demanded too great an effort from the interviewer and the respondent and did not work out well in actual practice. (It may be noted that the same rule is regularly used in the survey components of dual record systems.) The field staff numbered 250, and it was reported that promotion and demotion of staff according to their performance had a stimulatiing effect on their work, less because of payment differentials than for psychological reasons.

The 1970/71 survey of Burundi (ORSTOM, 1971) collected information on demographic rates and housing and covered a population of 30,000 in 24 clusters, an unusually large cluster size (1,250 persons) having been chosen as target. In the exact time span of 12 months for each area, five survey rounds were carried out by 24 local staff, led by one part-time supervisor, one Burundian and two French professional staff.

In these three national surveys, many different questionnaires were used: 10 in Tunisian and Algeria, and six in Burundi, some of them of two or more pages. Another feature common to surveys assisted by ORSTOM has been the creation of card indices (fichiers), either of individuals or of households, onto which the information collected in the field is entered (Cantrelle, 1974).

Until 1970, 16 different follow-up surveys had been taken or started in 11 French-speaking African countries. They investigated a total population of about 1 million, representing a universe of 33 million (ORSTOM, 1971).

A large national-scale follow-up survey was carried out in Côte d'Ivoire in 1978/79,

consisting of three rounds at six-month intervals. A two-stage sample in five geographical strata, based on the 1975 population census, comprised a population of over 200,000. The scope was also large, since it covered education and economic activity in addition to demographic information which was collected by means of both follow-up and retrospective questions at the first round, analysed by indirect methods. A great deal of attention was given to migration for which purpose there were questions on past migration and the sample population was classified into residents present, residents absent and temporary visitors. Among the problems met were mentioned the many tribal languages spoken and an initial lack of cooperation in the affluent quarters of Abidjan (Côte d'Ivoire, 1982). The survey was clearly successful, nevertheless. The follow-up data on births differed little from indirect fertility estimates. The follow-up data on deaths were believed to be about 15 per cent incomplete regarding newborn children and old persons, while the retrospective death data were estimated to be only 50 per cent complete and thus unusable. It was pointed out that there are popular taboos against mentioning death. The survey gave much interesting new information -- e.g., on mobility in a large African city and on demographic differentials according to the social level of the urban habitat (Côte d'Ivoire 1982).

Two unusual follow-up surveys have been carried out in West Africa after an interval of more than 10 years. Hurault (1960) used the records of an administrative census in Banyo, Cameroon, in 1954/55 to carry out a survey in 1967/68, and the findings were used by Henry (1969) for an analysis of differential mortality in the intervening period of 13 years. Quesnel and Vaugelade (1973) used the records of a sample survey of 1960/61 in Burkina Faso to conduct a follow-up enquiry 12 years later in a population of about 40,600. The experiments showed the feasibility of obtaining usable information in traditional tribal societies as even after such a prolonged interval over 90 per cent of the listed persons were recognized by respondents.

Outside the French-speaking countries, the follow-up method has been somewhat less intensively applied in Africa. In addition to an experiment in Kenya in 1963 (Blacker, 1964), three country-wide surveys, carried out with support from the United Nations and its Economic Commission for Africa, may be mentioned: rural Nigeria in 1965/66, Ghana in 1968/69 (Gaisie, 1973) and Lesotho in 1971-1973.

In Nigeria (Nigeria, 1968), the Federal Office of Statistics, which had two-person teams of statistical agents permanently stationed in 204 selected villages throughout the country, decided to use this organization for the collection of data on population change in a series of three rounds with six-month intervals. The permanent sample was stratified according to agricultural characteristics, because agricultural data were the main concern of the network. The sample was found suitable for demographic purposes as well, being spread, within each region over the rural areas approximately in the same proportion as the population. The average size of the 199 sample units in which the work was completed in time was 1,766 persons, and the total sample size 351,336 as of the first round.

Politics interfered with the first round; the second round was interrupted; but the third

round was taken. The analysis was based on the data of the first and third rounds only, which were 12 months apart. The results showed great unevenness in quality, particularly as to births, the more senior agents having recorded almost consistently more births than the newly recruited ones. There were some local birth rates as low as 1.5 and death rates of 2.4 per 1,000, with only minimal sampling errors. At the time of the data processing, the general situation in the country did not allow for any field checks. It was therefore decided to exclude from the analysis units in which the vital rate in question was more than 2 standard errors below the modal value for the region. After this screening, after adjustment to the census age distribution and after a further correction for estimated missed early deaths, the birth rate in rural Nigeria was estimated at 50.2 and the death rate at 26.9 per 1,000 population.

The main problems in the Nigerian survey were undoubtedly its very large size, the large numbers of personnel with uneven qualifications and weak supervision, and political events which interfered with the work. An additional factor may have been that training was given on the same occasion for the demographic survey and a labour-force survey, and the latter, being much more elaborate and difficult, received more attention at the training course.

The Lesotho demographic survey of 1971-1973 was a multiround follow-up operation covering a self-weighting area sample of some 115,000 persons. In the opening round, conducted in May 1971, the sample population, both de facto and de jure, was enumerated, and retrospective questions were asked on births and deaths during the preceding months, together with questions on orphanhood and, for adult females, on lifetime fertility and the date of the most recent live birth. In the second and third rounds, conducted at six-month intervals, the enumerators used the same form that had been used in the first round and asked about each person previously enumerated (whether he or she was now present, absent or dead). Adult females were asked if they had borne a child since the preceding round and, if so, whether the child was still alive. In the fourth round, again six months later, a fresh start was made, and the sample population was re-enumerated on a new form, similar to that used in the opening round but in which retrospective questions only asked about births and deaths during the preceding six months. Round five, six months later, was a follow-up similar to rounds two and three.

Another survey in Nigeria, the relatively small-scale (12,485 persons in 30 city blocks) Population Dynamics Survey of Lagos, conducted in 1967/68 by the University of Lagos College of Medicine, is an example of how a variety of special investigations, including vaccinations, consultations and diagnostic tests, can be attached to a demographic follow-up study in a large city (Morgan and Kannisto, 1973). The survey was undertaken in three rounds within a 12-month period. In addition to the demographic household questionnaire, which was updated each time through the recording of vital events and migration, the following enquiries and other activities were carried out:

(a) At the first round: enquiry into past incidence of measles, smallpox and vaccination (in 30 city blocks); enquiry into attitudes towards measles, smallpox and

vaccination (20 blocks); vaccination against measles and smallpox made available (10 blocks);

(b) At the second round: urine test for diabetes for persons aged 10 and over (30 blocks); enquiry into incidence of and attitudes towards epilepsy (5 blocks); survey of infant-feeding habits and weight of children aged 0-4 (30 blocks);

(c) At the third round: KAP survey on family planning (30 blocks); services offered by the family health clinic (30 blocks); Gravindex test for pregnancy (5 blocks).

This combination of efforts in Lagos was found advantageous to all sides. The special activities benefited from the available master sample, with its background data and organization. The demographic survey was strengthened by the infusion of additional resources, which also helped in establishing a good rapport with the population. It was found that the prolonged presence of the interviewer and of the other persons associated with him/her in the neighbourhood gradually dispelled the reserve and suspicion which often exist in a big city, not least among slum dwellers. In the course of time, the interviewer came to know of many persons whose presence had been withheld from him/her at the first visit.

Surveys in Latin America and the Caribbean

Quite independently, the Latin American Demographic Centre (CELADE) began to develop the follow-up method in 1960. It organized an experimental survey of 2,244 selected housing units in Guanabara, Brazil, carrying out three successive visits between January and June 1961 and a fourth visit for verification at the end of the year (CELADE, 1965). Another experiment was carried out by CELADE in Cauquenes, Chile, in an area of 12,274 inhabitants in 1964-1966 (CELADE, 1968). The results were sufficiently encouraging to lead to the first country-wide survey of this type on the continent, that of Honduras in 1970-1972 (Honduras, 1975). This was, in turn, emulated by national surveys in Peru in 1974-1976 (Peru, 1978) and in Panama 1975-1977 (Panama, 1978), but without CELADE participation.

The Honduras survey, designed to collect data on births, deaths and migration, was a cooperative project of the Dirección General de Estadística y Censos and CELADE and comprised four rounds within a total observation period of one year and eight months. The sample population at the initial visit was 34,444 in 134 area units, leaving outside the scope some sparsely populated areas of difficult access. The work was carried out by four supervisors and eight enumerators, working in four teams. The survey was judged very satisfactory: the operations ran smoothly, there was good co-operation from the public, and the cost was reasonable. The use of a single questionnaire for the duration of the survey helped make data processing sure and fast (Honduras, 1975).

The survey in Peru was carried out by Instituto Nacional de Estadística in 136 area units with a total population of 47,944, closely following the Honduras model. It comprised four rounds and spanned an average observation period of one year and four months. During

the last visit, a retrospective questionnaire on births and deaths was filled in. The results of the follow-up and the retrospective enquiry were not different, and it was felt that the quality of the latter was strongly and positively influenced by the previous visits. The survey was considered on the whole very successful, and it was concluded that one of the advantages of the follow-up method was that it could give valid results for subnational areas, free as it was from the migration bias that affected retrospective questioning (Peru, 1978).

The survey in Panama, undertaken by the Direccion de Estadística y Censo, was similar to those in Honduras and Peru. The objectives included births, deaths and migration, and the sample was composed of 427 area units with a total population of 50,910 at the initial visit, which was followed by two more visits. The average observation span was one year and four months. There was also a retrospective enquiry. This survey also was taken on the basis of usual residence, but it was reported that there were some difficulties with people with two residences: one in the village and another at an outlying farm. In indigenous areas, many persons stay away from home for long periods working on banana plantations, and that may cause them to be omitted from the survey (Panama, 1978).

Common to all the five surveys described above was the calculation, individually and in great detail, of the time exposure to risk (up to 1/1,000 of a year) on the basis of the dates of births, deaths, arrivals and departures. Whether this procedure leads to a gain in accuracy depends naturally on the reliability of the recorded dates and particularly on their being free from bias.

All the three surveys had an effective observation length of somewhat more than a year, thus making them susceptible to effects of seasonal variation. The results were prepared without adjustment for such possible effect.

Another survey of the same type in the Dominican Republic, conducted from December 1969 to March 1971, with four rounds, was not successful in determining current fertility and mortality. The reported reason was the too large size (14,000 households) and the large number of staff who did not produce the careful work and supervision needed (Dominican Republic).

The Multi-Round Demographic Survey of Haiti (Haiti, 1975a; Doménach, 1976) used the 1971 population census as the baseline, which was to be followed by three more rounds six, 12 and 24 months after the census. The purpose was to collect information, until then badly lacking, on natality, mortality and internal and international migration. In addition, data on economic activity, supplementary to the census, were collected at the second round. UNFPA had given considerable support to the population census, but the expenses of the demographic survey were borne by the Government.

From the census frame, in urban areas every twentieth enumeration section was selected for the sample, in rural areas every one hundredth. The resulting sample had a baseline population of 79,028, divided into 90 sections. The average size of the cluster was

878 persons, but there was unfortunately, a wide range, which created discontent among the interviewers of large units, since every interviewer was paid the same amount.

Due to the exceedingly tight financial situation of the Government, the follow-up rounds could not be taken at planned times and were instead conducted belatedly, as follows: second round in February/March 1973; third round in October/November 1973; fourth round in June/July 1975. The actual time intervals between rounds were thus 17, eight and 20 months, respectively. This naturally created unevenness in collected data and problems in analysis. The long intervals weakened the infant mortality information to the extent of making it unusable. The data on births were also affected. On the other hand, the data on mortality of adults and of children after infancy and on the migration data have proved very useful in shedding light on the contemporary demographic situation in Haiti (Haiti, 1976).

Surveys in Oceania

In Samoa, the 1971 census records were used for carrying out a follow-up enquiry in 1975, three years and four months later. Thirty-three villages -- one in every 10 in the country -- were selected for the study, including the only town, Apia, which is also divided into villages. In the census, 13,826 persons had been enumerated in the selected villages and of those 68.5 per cent were found in 1975 still living in the same village, 1.7 per cent had died, 28.1 per cent had moved away. On 1.7 per cent no information was obtained. Regarding those who had moved away, the respondents had recent information on 85.7 per cent to the effect that they were still alive. It is probable that among the remainder there has been an appreciable number of deaths. Births to women in the sample were also recorded and produced an average annual birth rate of 31.1 per 1,000, undoubtedly an underestimation (Samoa, 1975).

Another survey was organized in Samoa to estimate the population change after the 1981 census through follow-up of a 10 per-cent sample of enumeration blocks by means of semi-annual visits. The survey was originally planned for two years but, because of the satisfactory results in 1982 and the low cost involved, it was extended to four years (Samoa, 1983, 1984).

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