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THE DUAL-RECORD SYSTEM OF COLLECTING DEMOGRAPHIC DATA

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A. Introduction

1. In recent years two significant movements have been gathering momentum and are now having a dynamic impact on the form and development of population statistics, a field which only a few decades ago was a routine governmental activity of low priority and which in many countries was almost completely neglected. One movement of importance is the development of the concept of national planning. The idea that governments can make a rational plan for national social and economic progress and can make a balanced use of available resources is now a universally accepted and practical concept. The rapidly growing number and the increasing sophistication of national planning commissions and agencies is evidence of this. It will not be necessary to spell out the tremendous need that national planning creates for population data of many kinds.

2. The second important movement that is having an impact on population statistics is the realization of the existence of a "population problem" wherein the rate of growth, the geographic distribution, and the characteristics of a population may be presenting the greatest of all national planning problems. It is this second movement that is bringing an urgent need for additional and new kinds of population data - kind of data which will permit a prompt evaluation of governmental policies and programmes which aim to modulate population change.

3. The pressure of these two movements has created a level of activity in the population statistics field that has never been equaled in the past. There is a great expansion of national and international work related to promotion, evaluation, standardization, and methodological improvement of demographic statistics. There are, more than ever before, more conferences, more research projects, and more official and non-official studies. All this activity attests to the feeling that this is a technical field that must be improved and expanded - a field in which our methods and systems must be improved and for which the production of relevant data must be greatly increased.

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4. The dual-record system of getting more precise data on population change and related factors is one of the newer methods that has been developed. An understanding of the merits of this system requires some comparison with the main two prior conventional systems of collecting demographic data: (a) the periodic population census, and (b) the legal vital registration system. These two systems of data collection are necessary for a national demographic data collection programme, but additional data sources are also required. Each source is essential in a modern programme since each makes a contribution to the kinds and periodicity of data which are required. Of course, as utilized, the data collection systems require an overlay of data analysis and interpretation. These analytical methods and needs present another set of problems, and in this paper the focus is on data sources.

B. The Periodic Population Census

5. The first element of an adequate demographic data collection programme is the periodic population census. While rudimentary systems for counting or listing people reach back into antiquity, it was 100 years ago that the International Statistical Congress meeting in St. Petersburg (Leningrad) in 1872 was beginning to formulate the international recommendations that now form the basis of the concept of a modern census.

6. In the decade around 1870, only 29 censuses were taken in the various countries of the world. Through following decades the number of national censuses gradually increased until in the decade 1945-1954, some 65 national censuses were taken. In the decade 1955-1964, around the 1960 census period, some 224 censuses were taken. In Europe there were 41; in the Americas, 50; in Asia, 47; in Africa, 59; and in other regions, 28. The count of 224 censuses for the 1960 decade reflects, however, not only an increase in census programmes but also a substantial increase in the number of sovereign countries and separate territories that existed.

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7. Unfortunately, this extensive census-taking activity by no means satisfies the need for demographic data. The population census is a major multipurpose statistical procedure and in this capacity must serve many basic statistical purposes and provide essential national data on a number of topics. The content coverage in terms of the number of items included for any one subject is therefore quite restricted. The newer census practices of covering the total population with only a few basic items and using subsamples to expand the subject coverage greatly increases the scope of the census. Nevertheless, the census must limit the detailed subject coverage such as would be necessary for the intensive study of many topics.

8. While the limited range of topics covered by a census is one of its weak points, the geographic coverage of a conventional census is its strongest characteristic. By definition, the term "census" connotes a national census and accordingly covers the whole national territory with perhaps only minor omissions. Also, since by definition a "census" covers 100 per cent of the population, the volume of data is adequate to permit tabulation and detailed cross-tabulation in some detail for states or provinces, subnational regions, individual large cities, counties, and sometimes even for very small geographic units, such as census tracts or enumeration districts.

9. As a statistical tool for measuring population change, the census is weak in so far as the time factor is concerned. As a major and expensive nationwide statistical effort, the usual practice is to take a census at ten-year intervals. While a sequence of decennial censuses provides an excellent base for long-range studies of historical demography and the most complete data source for analyzing changes over past decades, the long interval between censuses does not provide a sensitive method of measuring current population change. In addition, the nationwide census requires the processing of a large bulk of detailed data with the result that in most countries, census tabulations, except for some provisional total figures, are typically not available for two to three years after the data of enumeration. This means that the most recent available detailed decennial census

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data are usually three to thirteen years old. With respect to the time factor, the census is certainly not an adequate statistical method for measuring current population change.

10. Although fundamental for national demographic data programmes, the census must be supplemented by several other procedures for collecting data if the increasing needs for a wide range of demographic data on a timely basis are to be satisfied. In addition, there still remain many improvements to be made in the traditional census procedures.

C. Civil Registration System

11. There is now increasing concern with improving the civil registration system in most countries. It is now more acutely realized that a registration system not only provides the essential individual proofs of birth and death that are needed for many civil purposes in a modern society, but that the statistical data which are a by-product of the legal system provide an important element of the demographic data programme. However, improving the registration system so that it serves a valid statistical purpose is certain, in every country, to be a long process. If complete, it is one method that does provide the basic demographic birth, death, and infant mortality rates. Since the registration is continuous, data can be aggregated for a single month, a quarter, or a year, and thus if the administrative collection and tabulation processes are efficient, these rates can be computed for small units of time and on an up-to-date basis. These desirable features are not always achieved, but the potential exists in the system. The strong advantage of the registration system, however, is that since registration records are essential for legal purposes, the system can have universal national coverage. This means that basic birth and death data can be available for small geographic areas and thus can be used to appraise the need for, and to evaluate the success of local public health programmes. This potential use of the system also is not always possible, partly because the computation of local rates requires also local up-to-date population estimates, as well as the tabulation of births and deaths on a basis that permits the vital

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events to be related to the correct "exposed-to-risk" population. These requirements are often difficult to satisfy.

12. The legal registration system, although an essential system, is often over-rated in its statistical value since it has intrinsic inadequacies in filling modern needs for data. Existing primarily as a legal system for establishing the fact of individual birth and death, the system is seriously constrained as a statistical system and fails to cover the wide range of important variables necessary to understand factors related to population change.

13. Authors too often consider the census and the vital registration system the only two essential elements of the demographic data system and consider other newer methods merely as interim measures until the first two are perfected. Both the census and the vital registration system are essential, but both have serious built-in limitations. A complete demographic data programme to be at all adequate for today's needs requires an additional basic procedure.

D. The Dual-Record System

14. Considering the intrinsic statistical deficiencies of the registration system because of its essentially legal character, its resistance to quick improvement, and the need for a broader data base for demographic analysis, there began to emerge, only a decade ago, the concept of a new data collection method which may be called the "dual-record" system. Tests of some version of this system have been going on in India, Pakistan, Turkey, Liberia, Colombia, Morocco, the Philippines, and Kenya. It is now being widely recognized that this experience is molding a new statistical procedure that is powerful and useful for demographic purposes and which supplements the traditional vital registration procedure. It is also now apparent that the success and flexibility of the new system will depend to a large extent on its administrative independence from the legal orientation and administrative channels of the civil registration procedures. It is a new system that is designed uniquely as a statistical system.

15. The novel nature of the emerging technique is somewhat obscured by the fact that all of the projects now underway in different countries have borrowed terminology from the traditional legal registration system and from the conventional population census procedures, and have applied these terms, with various modifications and in contradictory ways, to processes which are quite different from those which the terms, by UN recommendations and conventional practice, do describe. The result has been to introduce confusion into the literature and to conceal the fact that a distinctly new statistical system is evolving.

16. India has, by far, the most extensive system of this kind now in operation, but other countries have plans to follow. Unfortunately, the really important contribution that India is making is again obscured by the fact that the Indian system is called a "Sample Registration" system and the operational terms are borrowed from other statistical methods and misapplied. A new set of terms, distinct from those describing the older systems, is highly desirable.

17. The broad outlines of the new dual-record system can be sketched. The system is a dual-record vital event continuous surveillance system. The two records involved would comprise in one instance a "vital event record" and in the second instance a "survey record".

18. The system design is based on an appropriate number of small geographic samples. In each of these small area samples a vital event record is compiled currently and continuously for each birth and death by some form of a continuous vital event recording method. The second record, the survey record, is created by a sequence of independent periodic household interview surveys of the same geographic units. These surveys collect, inter alia, retrospective information on births and deaths which can be matched with the vital event record obtained by the continuous recording procedure. This permits the application of techniques which under certain assumptions produces an estimate of the number of events missed by both procedures and an accurate estimate of total births and deaths.

19. The vital event record is designed as a purely statistical schedule for the collection of a range of important items related to birth or death which will permit the occurrence of these events to be analyzed in relation to the demographic, social, and economic factors that give meaning to vital statistics vis-à-vis current population problems.

20. The second record of the new proposed system, the survey record, is also specially designed for statistical purposes to create the appropriate population bases for rate computation and to collect other survey data for the analysis of factors related to population change.

21. The very powerful character of this statistical system is apparent. The vital event recording process can provide information for two purposes - first, the production of a record of each vital event which can be matched with the survey record of the same event, and second, the collection of a range of additional variables about each birth and death to provide numerator data for the computation of any desired specific rate. The survey process can serve three purposes. One, to collect the necessary retrospective data for matching; two, to collect denominator data for an appropriate time period and in corresponding categories with comparable definitions and classifications required for the computation of specific vital rates; and three, the survey process can be used as a mechanism for the collection of demographic and fertility data or any other data about the sample population in addition to data required for crude or specific rate computation. Since the surveys are periodic, these supplemental items can be changed from time to time, thus providing a "mobile" section with which over a period of time a wide range of demographically related data can be compiled.

22. A principal advantage of the suggested system is that, designed as a sample system, it can be economical and timely since the sample size and the number of geographic units included can be adjusted according to the requirements for sampling precision, the detail of data required, the budgetary and other resources that are available, and the urgency for quick tabulation and analysis. Another advantage

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arises because of the independence of the system from the legal restraints and the usual decentralized organizational structure of the civil registration procedures. The third major advantage of the system is that, unique among statistical processes, the dual-record system has a built-in continuous quality control feature.

E. Estimating Procedure for Dual-Record System

23. The estimating procedure for the dual-record system is based on the Chandrasekar-Deming formulation and may be represented as follows:

Survey Subsystem	Recording Subsystem		Total
	Reported	Not Reported	
Reported	M	U ₂	N ₂
Not Reported	U ₁	Z	V ₂
Total	N ₁	V ₁	N

Where N₁ = total number of events reported by recording subsystem

N₂ = total number of events reported by survey subsystem

M = number of events reported by both subsystems - determined by matching individual records

U₁ = unmatched events reported by recording subsystem

U₂ = unmatched events reported by survey subsystem

Z = estimated number of events missed by both subsystems

$$Z = \frac{U_1 U_2}{M}$$

N = estimated total number of events

$$= M + U_1 + U_2 + \frac{U_1 U_2}{M} = \frac{N_1 N_2}{M}$$

24. Taken from actual experience a set of illustrative data is given below:

Illustrative Birth Data for Dual-Record System

Survey Subsystem	Recording Subsystem		Total
	Reported	Not Reported	
Reported	1536	431	1967
Not Reported	503	141	644
Total	2039	572	2611

From this we can see that the estimated total number of births is 2611. Taken by itself the recording subsystem gave 2039 births or an underestimate of 22 per cent. The survey subsystem by itself gave 1967 births or an underestimate of 25 per cent. Both subsystems missed or estimated 141 births or slightly more than 5 per cent of the estimated total. The data given in this illustration are typical of the results found in many trials of the recorder procedure and the survey procedure. Each procedure is inadequate, but taken together they give a much firmer estimate of the total number of births than either procedure would give alone.

F. Design Problems of the Dual-Record System

25. While it is easy to point out the advantages of the dual-record system, it should not be assumed that it automatically gives perfect results. Many technical aspects of the system including sample size and design, sample rotation methods, estimation procedures, periodicity and reference periods for the survey process, present technical methodological problems which must be solved. Neither of the two procedures succeeds in "capturing" all the events. However, the strength of the dual-record system is based on a recognition that no single system will ever record all vital events. Any continuous statistical system needs constant vigilance and constant efforts for

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improvement if it is to improve and not deteriorate. In addition to the importance of continuous efforts to improve administration and supervision, there is also the need for research on technical aspects of the system.

26. As stated, the dual data collecting operations consist of a periodic survey procedure and a continuous recording procedure. The survey procedure is similar to other types of household interview sample surveys and there is substantial experience relating to the design, conduct, and control of such surveys. Certain other problems are unique to the use of the survey procedure as an element of the dual-record system. A major defect of the survey subsystem is that it is not an accurate method for collecting retrospective reports on vital events and this inaccuracy increases as the recall period is lengthened. This would seem to indicate that the periodic survey should be taken with a short recall period. Also, in order to match retrospective survey reports of vital events with currently recorded events, the retrospective survey procedure must follow in time a period for which events are recorded currently. On the other hand, to serve as a source of denominator data for rate computation it would be preferable if the survey preceded or was midway in the period for which vital events were recorded.

These considerations would seem to indicate that the surveys should be taken frequently, but this leads to a design that increases the cost of the method and may lead to a too intensive resurveying of the same respondents. A frequently repeated survey procedure is also not required for its use as a vehicle for the collection of other demographic variables since these may change only slowly with time, and a frequent collection of such data would probably overburden the resources and time that can be used for data processing and analysis

27. In contrast to the survey procedure, the recording procedure is a relatively new statistical operation for which there is little experimental data indicating optimum design and method. The process of recording vital events in the dual-record system is distinctly different from the usual passive method of operation of the "registrar"

in the traditional civil registration system. The recorder in the dual-record system must follow active methods for obtaining a current record for each birth or death that occurs in the population in his surveillance area.

28. Two general methods, each with various modifications have been used, but there is as yet insufficient evidence to indicate their relative utility or to permit a careful evaluation of the conditions for which each method is preferable. One method is for the recorder to compile a complete roster of the members of each household in the area for which he is responsible and by periodic revisits to the household to obtain information about each addition to or subtraction from the roster. This procedure would seem to be effective, but if the visits are too frequent, the respondent reaction would certainly be unfavourable, and if the visits are too far apart, then this process falls into the same pattern of recall-loss errors as the survey method. The other method of operation is for the recorder to establish a chain of reports based on a network of community contacts by getting information on births and deaths from hospitals, doctors, midwives, burial ground custodians, local registrars, etc., and following up on each reported event with a household visit to obtain verification and additional data. The exact procedures by which either of these two methods would be carried out would depend in part on the size of the cluster or recording area for which one recorder was responsible; whether the recorder worked on a full- or part-time basis; as well as other considerations such as the concentration or dispersal of the population, travel, and communication facilities, etc.

29. Undoubtedly, the recording process presents a number of difficult design and operational problems. Births and deaths, in spite of the population explosion, are relatively rare events. The problems of collecting data, for example, on the characteristics of a population, where every person has a sex, age, and other demographic, social and economic attributes, are quite different from getting an accurate count of vital events where continuous observance of a thousand people over a full year would reveal less than one birth event per week.

30. There are other basic problems which must be investigated before the optimum dual-record system can be designed. Obviously, the validity of the estimation procedure depends upon the correctness of the matching of the records from the two subsystems. A too rigorous or a too loose criteria for matching will produce estimates that are not accurate approximations to the correct figures. A good deal of research work is directed at developing an optimum matching criteria.

31. Perhaps more than technical problems with various aspects of the system is the importance of rigorous control of the field collection of data and of the office data-processing operations. The greatest danger to a successful dual-record design is that the objectives will be over-extended so that this adequate control cannot be maintained. The definition of achievable objectives, the optimization of the design in terms of survey frequency, recorder procedures, matching criteria, and a general acceptable cost-effective ratio for each element of the system remain problems for which final answers have not yet been obtained.

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