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SAMPLE REGISTRATION SYSTEM IN INDIA

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SUNIL K. SINHA*

Introduction

The alarming growth of population in India has immensely heightend the need for keeping a close track of the components of natural increase, the birth and the death rates. With the realisation of the impact of population growth on every aspect of social and economic life of a nation, consideration of the levels of fertility and mortality and their control has become the concern of planners and administrators. It is, therefore, imperative in the days of planning to know how the gap between birth and death rates is widening so that ways and means may be found to cater to the needs of the growing population for basic necessities like food, clothing, shelter and education. India being one of the few nations to launch official family planning programmes needed reliable vital rates. The increasing acuteness of population problem in India, therefore, resulted in more insistent demand for reliable vital rates.

In order to measure short-term changes in the growth of population for various purposes like projecting the future trends in population, in evaluating the results of family planning programmes, etc., there is need for sources other than the Population Census. Although India has nearly more than a century old system of registration of birth and death under the Civil Registration System (CRS), still it is incomplete and not suitable for providing statistics of births and deaths for measuring continuous change of population. In this context, the techniques of sampling for the collection of vital statistics through large scale demographic sample surveys has now been recognised as a powerful tool for obtaining quick estimates of vital rates with a desired precision. Accordingly the Conference on Improvement of Vital Statistics held in New Delhi in 1961 recommended a scheme of Sample Registration of

Births and Deaths, based on continuous enumeration of events in sampled areas coupled with an independent survey at six monthly interval. Subsequently the Working Group set up by the Planning commission to consider the various schemes of improvement of registration of vital events approved it as one of the centrally sponsored schemes under the Third Five Year Plan with assistance from the Ford Foundation for the initial two years. Based on encouraging results on the basis of several pilot surveys during 1964-66, the scheme of the Indian Sample Registration System (SRS) of births and deaths was initiated on regular basis in randomly selected sample of rural and urban areas of all States and Union Territories and became fully operational from 1969-70.

What is SRS?

The Indian Sample Registration System (SRS) is a large scale demographic sample survey based on dual recording system of births and deaths. The main objective of the Sample Registration System is to

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provide reliable estimates of birth and death rates at the state and national levels for rural and urban areas separately. It also provides various other measures of fertility and mortality. Besides providing estimates of fertility and mortality indicators, the SRS data are also used for preparation of abridged life tables and various analytical studies.

The field investigation under Sample Registration System consists of continuous enumeration of births and deaths in a sample of villages/urban blocks by a resident part-time enumerator, and an independent six monthly retrospective survey by a full-time supervisor. The data obtained through these two sources are matched. The unmatched and partially matched events are reverified in the field to get an unduplicated count of correct events. The advantage of this procedure, in addition to elimination of errors of duplication, is that it leads to a quantitative assessment of the sources of distortion in the two sets of records making it a self-evaluating technique.

Organisation

At the national level, the Vital Statistics Division of the Office of the Registrar General, India co-ordinates the implementation work, formulates and prescribes necessary standards, provides necessary instructions and guidance, undertakes tabulation, dissemination and analysis of data and prepares technical reports.

Implementation of SRS started as a joint venture of the Central and State governments and is being done through the Directorates of Economics & Statistics/Directorates of Health Services and the Directorates of Census Operations. The implementing agencies for the rural sample are the respective Directorates of Economics & Statistics in the States of Kerala, Madhya Pradesh and Maharashtra, Directorates of Health Services in Andhra Pradesh, Gujarat, Haryana, Orissa, Punjab, Tamil Nadu, Directorate of Census Operations in these (except Kerala) and the remaining States/Union Territories. The implementing agencies for the urban sample are the Directorates of Health Services in Haryana, Orissa and Punjab, and the Directorates of Census Operations in the remaining States/Union Territories.

For continuous enumeration, there is an enumerator for each sample unit, who is usually a resident teacher employed on a part-time basis and is paid a small honorarium for this purpose. For supervision and conduct of half-yearly surveys, there are full-time supervisors at the state headquarters. One supervisor is usually assigned a set of 10 sample units for conducting half-yearly surveys. The state headquarters have a complement of staff necessary for planning and organising various field operations, training of the field staff, effecting proper supervision and control, ensuring regular flow of returns from the field, forwarding of various returns to the Office of the Registrar General, India and for undertaking certain minimum tabulations. The organisational chart of SRS is given in Figure 1.

Basic Structure

The main components of SRS are :

- (i) **Base-line survey** of the sample units to obtain usual resident population of the same sample areas;
- (ii) **Continuous enumeration** of vital events pertaining to usual resident population by the enumerator;
- (iii) An independent **half-yearly survey** for recording births and deaths which occurred during the half-year period under reference and up-dating the Houselist and Household schedule by the Supervisor;
- (iv) **Matching** of events recorded during continuous enumeration and those listed in course of half-yearly survey; and
- (v) **Field verification** of unmatched and partially matched events.

A **Baseline survey** is carried out in each sample unit before initiation of continuous enumeration of births and deaths in the sample area. The Baseline survey consists of identification of the sample area, preparation of notional maps, house numbering and canvassing of house-list (Form 1) and household schedule (Form 2). Wherever a sound system of house numbering exists the same is adopted. Otherwise, the house numbering is done by the enumerator/supervisor with the help of chalk and tar, etc. at conspicuous place near the entrance of the house. The supervisor prepares a notional map with the help of the enumerator showing important landmarks and location of the houses covered by the sample unit. He then prepares a list of all houses located in the sample area in the House-list (Form 1) and fills-in the Household Schedule (Form 2) wherein he records the residential status and demographic particulars of each individual residing in the household e.g. name, sex, age, marital status and relation to head of household. Visitors to the household on the specified date, who are likely to stay in the household for fairly long period, are also listed and their residential status is shown as 'V' as against 'UR' for usual residents. The inmates of public institutions like hotels, inns, schools and hospitals are excluded, but house-holds living permanently within the compound of such institutions are covered. After the Baseline survey listing of details of each birth and death events occurring in the area is recorded every month on a continuous basis. Such a **continuous enumeration** is done by an enumerator appointed on a part-time basis. The enumerator records details of all birth and death events occurring in the area in prescribed forms and sends these details to the state headquarters every month.

The enumerators are expected to record the details of all events of birth and death as part of the continuous enumeration but the possi-

bility of certain events escaping their notice or wrong inclusion of some events cannot be ruled out. Accordingly, an independent survey of births and deaths every six months (January and July) called **half yearly survey** is subsequently carried out by another official called supervisor who visits each household residing in the sample area and records details of each birth and death event occurring in the household during the six monthly period (January-June and July-December). Before the initiation of the two half-yearly surveys, due in July and January and covering the January-June and July-December periods respectively, the records of the enumerators are withdrawn from the field for ensuring complete independence. The Supervisor also updates the baseline records i.e. the houselist and the household schedules along with the list of pregnant women. Updation of the household schedule enables the supervisor to prepare age, sex and marital distribution of usual residents of the sample area which is required for the calculation of the vital rates.

After the completion of the half-yearly survey the results are compared and **matched** with records of the enumerators pertaining to each event of birth and death. The items considered for matching of the two records are i) house/household number, ii) name of the head of the household, iii) name of the mother/name of the deceased, iv) residential status, v) sex and vi) month of occurrence. If all the matching criteria tally, the event is termed as matched. Otherwise events are classified as partially matched or unmatched. Partially matched and unmatched events are verified by revisiting the concerned households. Based on the results of the reverification an unduplicated count of birth and death events is prepared for each sample area. These finalised results along with the updated population are sent to the Office of the Registrar General, India (ORGI) for preparation of vital rates.

SRS Forms and their flow

For collecting information on population and vital events various forms/schedules have been prescribed under the SRS. Depending upon various operations under the system the following 17 types of forms which have recently been revised and in use are:

A. Baseline Survey Forms

- Form 1 : House List
- Form 2 : Household Schedule
- Form 3 : List of pregnant women

B. Continuous enumeration Forms

- Form 4: Births recorded by Enumerator (January-June/July-December)
- Form 5: Deaths recorded by Enumerator (January-June/July-December)
- Form 6: Monthly report of Births
- Form 7: Monthly report of Deaths

C. Half yearly Survey Forms

- Form 9: Births recorded by Supervisor (January-June/July-December)
- Form 10: Deaths recorded by Supervisor
- Form 15: Distribution of usual resident population by age, sex and marital status (as on 1 July/1 January)
- Form 16: Distribution of Female population by broad age group and level of education (as on 1 July - a newly introduced form)
- Form 17: Number of females who got married by age at effective marriage (January-June/July-December)

D. Compilation/Tabulation Forms

- Form 8: Consolidated monthly report on births and deaths
- Form 11: Finalised list of Births (January-June/July-December)
- Form 12: Finalised list of Deaths (January-June/July-December)
- Form 13: Results of the HYS for Births (January-June/July-December)
- Form 14: Results of the HYS for Deaths (January-June/July-December)

Every enumerator is required to send to the state headquarters in the first week of the following month a monthly report on births and deaths (Forms 6 and 7) in duplicate based on entries from the birth and death records (Forms 4 and 5) kept with him for six months prior to initiation of the half yearly surveys. On the basis of the monthly reports received from the sample units, the state headquarters are required to prepare a consolidated monthly report (Form 8) and forward the same to the Office of the Registrar General, India by the end of the following month. The monthly reports for the individual units remain at the state headquarters. The supervisor records details of each birth and death events occurring during the six month reference period in Forms 9 and 10 respectively. After matching of each birth and death event recorded in Forms 4 and 5 with those in Forms 9 and 10 and verification of partially and unmatched events in the field, finalised forms 11 and 12 are prepared after necessary corrections and inclusion of additional events recorded during the survey. These forms are sent to the Office of the Registrar General, India alongwith the half-yearly survey results in Form 13, 14, 15, 16 and 17. Flow chart of SRS returns is shown in Figure 2.

Items of information

In addition to information on sex, age, residential and marital status of the population collected during the baseline survey and updated subsequently during the half yearly surveys (HYS), details of each

birth and death event are recorded both by the enumerator and the supervisor during continuous enumeration and the HYS respectively. Information on births include: i) place of birth; ii) date of birth; iii) live birth or still birth; iv) single or multiple birth; v) sex; vi) particulars of the mother who delivered the child (her age, residential status and relationship to head of household); and vii) type of medical attention at delivery. Similar data are also collected in respect of each death event. Based on certain recommendations of a Technical Committee on SRS, additional data on live birth order, interval between current and previous live birth and age at effective marriage are also being collected in the SRS since 1990. Data on educational level of the mother and information on total number of children ever born and surviving have also been added subsequently. Collection of additional data has obviously increased the workload of the personnel charged with conduct of the half yearly surveys.

Sample design

The Sample design adopted for SRS is a unistage stratified simple random sample without replacement. In rural areas, each state has been divided into a number of natural divisions. These natural divisions or regions were formed by grouping contiguous districts having similar topography, population density, cropping pattern and rainfall etc. Each natural division within a state has been further stratified by grouping villages into four population size classes : (a) less than 500, (b) 500 to 999, (c) 1,000 to 1,999 and (d) 2,000 and above. In order to cover the village by one part-time enumerator, large size villages having population of more than 2,000 have been segmented into two or more segments of equal size. A simple random sample of villages and segments has been selected without replacement in each State/Union Territory. In urban areas stratification has been done on the basis of size class of the towns/cities. The towns/cities were grouped into five classes, viz:- (a) towns with population below 20,000, (b) towns with population of 20,000 and more but less than 50,000, (c) towns with population of 50,000 and more but less than 100,000, (d) cities with population of 100,000 and more but less than 1,000,000, and (e) cities with population of 1,000,000 and above. Each city with population 1,000,000 or more was treated as a separate stratum. The sampling unit in urban area is a census enumeration block. A simple random sample of these enumeration blocks has been selected without replacement from each of the size classes of Towns/cities in each State/Union Territory.

In the existing sample design the rural sample units have been selected by size classes of villages for a group of districts called natural divisions. As such all districts in a State are not necessarily represented in the sample. Demographers and other data users have been pressing hard to give representation of each district in the SRS sample. Accordingly it is now proposed to marginally modify the sample design by selecting the sample units from each district in proportion to their share in State's population. In view of the small number of rural units for a district, the size classes are also proposed to be reduced to only two i.e. villages having population 1,500 or more and villages having population less than 1,500. Villages with population 1,500 or more will now be segmented instead of villages with population 2,000 or more.

Sample Size

When the SRS was initiated on full scale the sample size for rural areas was determined by using a binomial model assuming the value of the parameter to be 0.04 (or a birth rate of 40 per 1,000 population) with a coefficient of variation of 1 per cent. The rural sample size for major states accordingly worked out to be around 150 villages. In urban areas, the sample size varied from 60 to 100 urban enumeration blocks depending upon state's level of urbanisation. Based on these allocations the SRS originally operated in about 3,700 sample units selected from the 1961 census frame, of which around 2,400 units were in rural areas. It covered a population of 4.2 million representing about 0.7 per cent of the rural population and 1 per cent of the urban population. Subsequently the sample size has been increased by 1700 and 600 in two phases and presently the SRS is being operated in 6022 sample units of which 4149 units are in the rural areas and the rest are in urban areas. The percentage of population covered under SRS has, however, remained around 0.7 per cent. Assuming that the binomial model still holds good and ignoring the effects of clustering (i.e. design effect) for estimating the birth rate, which is now around 30 per 1,000 population, the population required to be covered at the State level will be around 325,000 with a coefficient of variation of 1 per cent. The sample population presently covered under SRS along with the sample size is given in Table 1 in Appendix 1. The present sample is, however, not adequate enough to provide reliable estimates of vital rates below State level. A technical Committee on SRS has recently recommended increase in the present sample by 825 additional units for providing below State level estimates of birth rate with standard error of 3 per cent.

The sampling unit in SRS is a village/segment of a village and an enumeration block and as such is a cluster of individuals. Since vital events relate to individuals, assumption of binomial distribution for, say, births, leaves scope for the cluster or the design effect (deft). If deft is also taken into account then a very large sample is required for estimation of vital rates which is cost prohibitive and administratively difficult to be managed efficiently. Clustering of individuals, on the other hand, often results in reduction of cost. Moreover, being a dual record system, some amount of sacrifice is inevitable in terms of efficiency of the estimates.

Estimation Procedure

When the SRS was launched on a full scale basis around 1969-70, the rural sample design was a unistage stratified simple random sample while in urban areas a two-stage stratified sample random sample design was adopted. The population, births and deaths were estimated using a ratio method of estimation with the 1961 population of the sample unit as an auxiliary variate for rural areas. For urban areas, unbiased method of estimation was followed. The estimation procedure for rural areas faced some problem in case of segmented villages. Accordingly, the unbiased method of estimation for population, births and deaths has now been adopted both for rural and urban areas and the sample design for urban areas also being unistage stratified simple random sample. Appen-

dix 2 gives the mathematical note on the estimation procedure adopted in SRS alongwith calculation of sampling errors of the vital rates. Estimates of vital rates based on SRS data for India are given in Table 2 in Appendix 1.

Types of errors and their control

Like any large scale sample survey, data based on the SRS are subject to both sampling and non-sampling errors. The magnitude of sampling errors has been assessed for the estimates of vital rates based on SRS data. Estimates of standard errors of the vital rates are now regularly available from the year 1984 when the present sample replaced the old sample completely. Earlier these variability estimates are available for the period 1968-70 for rural areas only and for the years 1975 to 1977. These estimates are shown in Table 3 in Appendix 1. With increase in the sample size the sampling variability of vital rates has declined.

The non-sampling errors, on the other hand, have not yet been quantified. In the SRS non-sampling errors may arise from i) failure to net vital events/population in some sample units; ii) erroneous inclusion/exclusion of events/population due to measurement problem; iii) errors introduced at the time of baseline survey; and iv) matching errors. Several measures are taken to control such errors in the field. In order to perform their duties properly and accurately and to maintain uniform concepts and standards in work, the enumerators and the supervisors are exposed to intensive training both at the time of initiation of the baseline survey and subsequently through refresher training programmes. For this purpose detailed manuals of instructions are prescribed separately for the enumerator and the supervisor. The training programmes make the field and supervisory staff well-conversant with the various concepts and definitions, types of inconsistencies in the filled-in schedules, problems encountered in the field, compilation and tabulation of data, matching problems, response bias, etc. These training programmes have helped the field staff in removing deficiencies arising from variations in the field work and related operational problems. In turn the non-sampling errors have declined.

There are several methods built into SRS to achieve full coverage and to reduce non-sampling errors. In rural areas, the enumerator has a set of informants like village headman, paramedical personnel, priest, etc., through whom he gets information about occurrence of any birth or death event accurately. He also makes door to door enquiry every quarter so as to detect events missed by him during continuous enumeration. Another feature introduced in SRS is the use of over-lapping reference period called extended reference period. While recording vital events which occurred during a given half-yearly survey, the supervisor also records events missed by him during the preceding half-yearly survey in a separate form.

SRS is a field oriented operation. The success of the system in ensuring full coverage of events depends on the efficiency of the field functionaries. The field work is, therefore, monitored very closely and random field inspections are undertaken by supervisory level officials.

In order to monitor the type and quantum of inspections undertaken a monthly proforma has been evolved. At the close of each half-yearly survey, the implementing agencies are required to send the proforma giving details regarding time taken at various stages of operations, results of the survey and details regarding intensive field checks in aberrant units. Sample units are identified as aberrant on the basis of the trend in the recording of events and population. Implementing agencies are advised to undertake intensive field checks in such units and ensure the quality of the reported information on events and population. In addition to these measures, review meetings are held at regular intervals in which the Registrar General, India interacts with the field managers of the SRS. Besides taking stock of the progress made and problems encountered in the field, these meetings/conferences provide a forum for discussing the technical and operational problems for promoting a uniform understanding of the system.

Use of SRS for special studies

The Sample Registration System (SRS) has potentialities for taking up a variety of demographic studies within the framework of the system. It can also be used as a testing ground for methodological studies. The SRS records serve as a useful source for record-check studies such as **Census Evaluation Studies**. The census records of 1971, 1981 and 1991 have been matched with that of the SRS for relevant periods for measurement of under-enumeration of children.

Another area where SRS records can be used is in the measurement of under enumeration in the civil registration system (CRS). Attempts are being made to undertake some pilot studies in selected areas of the countries where civil registration system is functioning well for **matching of CRS and SRS records** of vital events. It is also proposed to collect data on probable **cause of death** on the basis of lay diagnostic procedure as followed in the scheme of "survey of causes of death" for rural India being executed by the ORGI in selected areas. Such type of data may be collected once in 3 or 5 years since inclusion of this additional burden on the field workers is likely to affect the quality of regular SRS data on population, births and deaths.

The SRS infrastructure has also been utilized to collect additional data on fertility and mortality and their socio-economic correlates by conducting periodic special surveys along with the regular SRS half-yearly survey. Soon after initiation of the SRS, a detailed fertility survey was conducted in 1972 in a sub-sample of SRS households. This survey yielded valuable data on fertility differentials by socio-economic groups and also data on historical fertility. Another special survey on Infant and Child Mortality was conducted in 1979 as part of the International Year of the Child. Information on infant and child mortality and also on fertility were collected. The survey provided estimates of infant and child mortality, the pattern and differentials in fertility and child mortality and health and child care of infants and children. The last survey taken up in SRS was the Fertility and Mortality Survey of 1984. A number of reports dealing with socio-economic differentials in fertility levels and mortality and also on age at effective marriage were brought out. Due to preoccupation with 1991

Census activities no special survey has been undertaken in SRS units after 1984.

Evaluation of SRS

The Sample Registration System (SRS) has been evaluated periodically using both direct and indirect methods. The direct method consists of taking up an intensive enquiry in a sub-sample of SRS units selected randomly. The investigation is done by higher level staff by canvassing a special questionnaire containing probing questions. The events recorded in the intensive enquiry are matched with those recorded in SRS to obtain a measure of the extent of omission of events in the SRS. In the initial stages of implementation of SRS, some of the implementing agencies conducted intensive checks in units found deficient in regard to netting of events. A comprehensive intensive enquiry covering all major States/Union Territories was taken up for the first time in 1980-81 followed by another enquiry in 1985 by the Office of the Registrar General, India. Attempts were also made in the past by various scholars to study the extent of completeness of events recorded in SRS. These include studies conducted in Kerala, 1966-67 (Kurup R.S., 1968), in Kurnool district of Andhra Pradesh, 1968 (Sastry V.V. and Raju R.S., 1968), in Jammu and Kashmir, 1968 (Abdul Gani and Kalla, H.L., 1969), and in urban areas of Andhra Pradesh, 1973-74 (Lal R.B. and Swamy V.S., 1976). The results of the intensive survey of 1966-67 in rural areas of Kerala revealed that the extent of omission of births was 8 per cent and of deaths 5 per cent. The 1973-74 enquiry in urban areas of Andhra Pradesh gave the extent of omission of births around 7.7 per cent and for deaths around 9.2 per cent. The results of the two comprehensive intensive enquiries conducted in 1980-81 and in 1986 are given in Table 4 in Appendix 1.

In recent years several indirect techniques have been developed for estimating fertility and mortality. These methods also serve as useful tools for evaluation purposes by providing alternate estimates which can be compared with those already available. Using some of these indirect methods the extent of under-reporting of births in SRS was about 2.5 per cent at the national level for the year 1978. A recent study which evaluated SRS estimates of fertility and mortality using indirect regression estimates revealed that both fertility and mortality estimates from SRS are "remarkably good" (Swamy, Saxena, Palmore, Mishra, Rele and Luther, 1992).

Replacement of Sample units

The present sample of 6022 units are based on the 1981 census frame. With the availability of the new frame of villages/urban blocks from the 1991 census, it is proposed to replace the present sample by a new sample. Ideally a rotational sample would have been preferred but due to administrative problems the sample will be replaced in a phased manner within three years. The urban sample has now been replaced with effect from January 1993. Half of the rural units will be replaced from January 1994 and the remaining from January 1995. Replacement of any sample unit requires a number of steps such as identification of the

sample area, preparation of a correct notional map depicting the location of houses/households, appointment of part-time enumerator and his/her training followed by conduct of baseline survey before initiation of the continuous enumeration.

Conclusion

The Sample Registration System is the largest continuous demographic survey undertaken in India. Its distinguishing feature is the longitudinal recording procedure which ensures the continuity of the recording of vital events by local resident enumerators. The system attempts to minimize the recall bias while the biannual survey by the supervisor ensures full coverage of vital events. Effective supervision, adequate control over field staff and constant monitoring are necessary to ensure the complete recording of events and the validity of the results. The establishment and maintenance of such a system are comparatively more expensive than a multi-round survey.

Unlike the multi-round survey, the Sample Registration System, which is a dual-record system, has the advantage of being self-evaluating. There is a built-in procedure for the comparison of data collected by two different agencies, thus lending credibility to the results because the probability of events being missed by both agencies is low. To that extent, the Sample Registration system is more reliable than a multi-round survey.

The Sample Registration System provides reliable estimates of fertility and mortality indicators and has great potential for a variety of demographic studies. Special studies undertaken with its framework have yielded reliable data on fertility and mortality differentials by socio-economic group. The system has been the main source for dependable data on vital demographic measures in India.

The utility of the information obtained from the Sample Registration System scarcely needs any emphasis. Information on the number of birth/deaths by place of occurrence helps the study of the geographical distribution of births/deaths in relation to local health conditions. The number of births/deaths by type of medical attention received at the time of delivery/death provides an indicator of the extent of use or availability of medical facilities in different regions. The distribution of births/deaths by age of mother/age of deceased is essential in identifying the vulnerable age groups in order to help formulate detailed maternal, child and public health measures to reduce fertility and mortality. The data are also useful for the construction of life tables.

The data from the Sample Registration System have numerous uses in policy and programme formulation in the health and family welfare sector. The infant mortality rate is a general indicator of the availability and quality of child health services and is also a measure of the health and sanitary conditions in a given area. It is a critical indicator for measuring progress in the reduction of infant deaths. Infant mortality broken down into its two components of neonatal mortality and post-neo-natal mortality are important from the point of view of medical

research and information on post-neonatal mortality is useful for environmental and medical control programmes. Data on perinatal mortality also serve as an indicator to the public health authorities with regard to the facilities necessary or available to expectant mothers. The Sample Registration System has uses not merely in policy formulation for family welfare and health measures but for other analytical needs. For example, its frame is adopted in evaluatory surveys, such as the census evaluation study. The system also provides data for the evaluation of the impact of the family planning programme in terms of its ultimate objective of reduction of fertility. Another sector in which data obtained in the system could be used is in determining under-registration in the civil registration system through matching procedures. It is these numerous uses of the Sample Registration System for policy formulation and determination of programme content that make it extremely important.

The federal structure in India results in a multi-level organisation for implementation of the Sample Registration System, which requires close co-ordination. The responsible agencies in the states are the Directorates of Health Services or the Bureaux of Economics and Statistics. These agencies have their own priorities in terms of what their state governments consider important; and as the implementing agencies, they usually have their own ongoing statistical schemes. Therefore, there is some element of competition for attention between the regular work of these agencies and the Sample Registration System; the technical personnel of the agencies generally are inclined to pay more attention to the department's regular work. This administrative reality has to be recognized and it necessitates a high degree of co-ordination and centralized monitoring. Of late, it is proposed to implement the SRS through the Census Directorates only for effective control by Office of the Registrar General, India.

In implementing the Sample Registration System, the major consideration is more administrative than technical because controlling the quality of the results would essentially mean controlling non-sampling errors. Although sound design and sample selection can, by and large, be ensured, the efficiency of the system critically depends upon the availability of well-trained personnel, firm control over the phases of the field operations, including the biannual surveys; meticulous attention to monitoring of performance; adequate supervision to instil discipline and to ensure that no attempt shall be made to avoid work and the careful processing of data.

A P P E N D I X - 1

(Selected Statistical Tables based on SRS data)

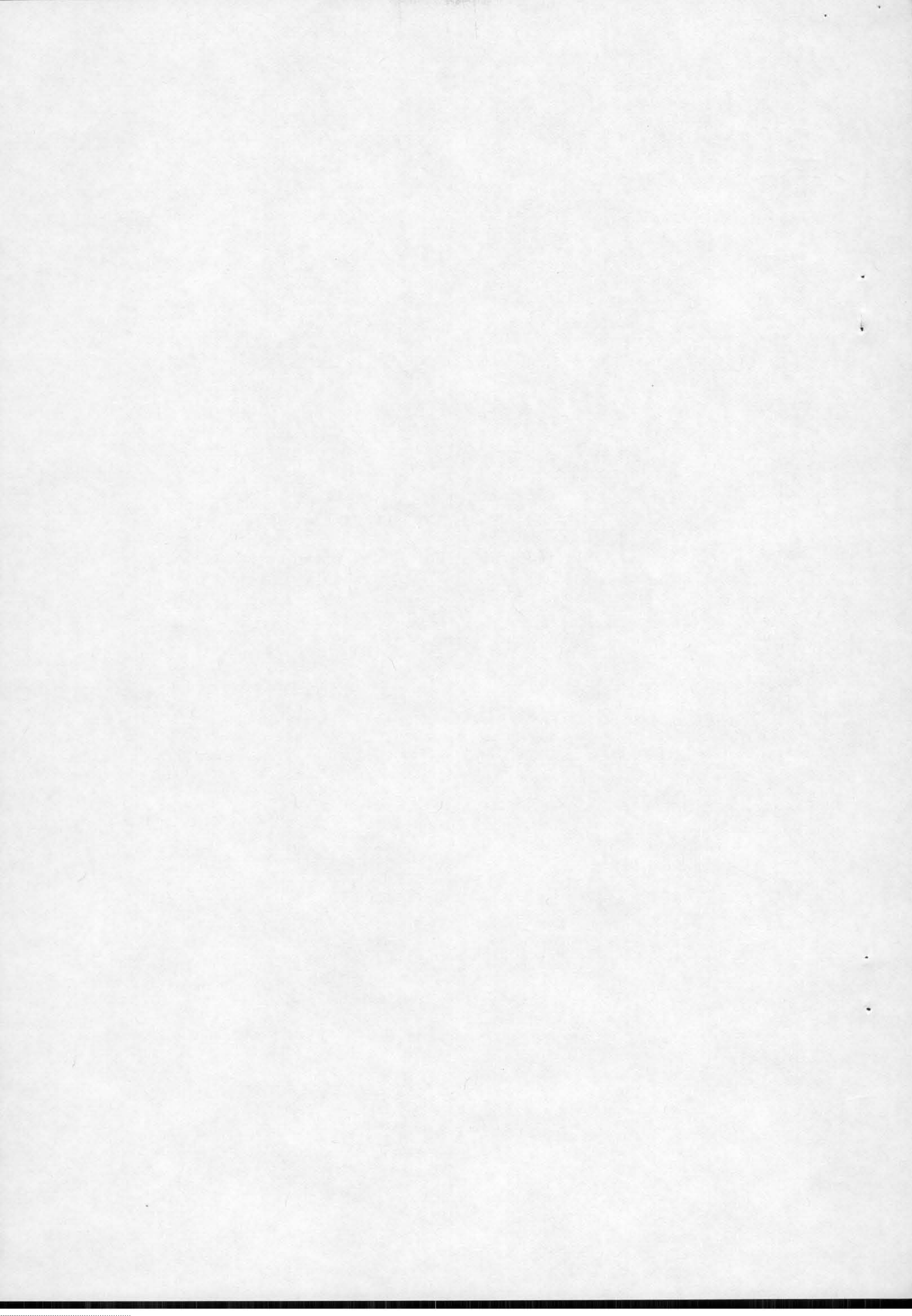


TABLE - 1

Population covered (1991), No. of Sample Units
and average sample size.

States/ Union Territories	Sample Population			No. of units			Average Sample Size		
	Com- bined	Rural	Urban	Com- bined	Rural	Urban	Com- bined	Rural	Urban
<u>States</u>									
Andhra Pradesh	366707	256192	110515	290	190	100	1265	1348	1105
Arunachal Pr.	25490	20863	4627	50	45	5	510	464	925
Assam	291432	234949	56483	254	200	54	1147	1175	1046
Bihar	511301	440640	70661	500	400	100	1023	1102	707
Goa	65381	49873	15508	63	36	27	1038	1385	574
Gujarat	321819	270815	51004	300	200	100	1073	1354	510
Haryana	178107	136658	41449	160	100	60	1113	1367	691
Himachal Pradesh	69917	54553	15364	140	115	25	499	474	615
Jammu & Kashmir	N.A.	N.A.	N.A.	166	100	66	N.A.	N.A.	N.A.
Karnataka	397765	291763	106002	360	250	110	1105	1167	964
Kerala	326122	266260	59862	240	150	90	1359	1775	665
Madhya Pradesh	294056	232200	61856	400	300	100	735	774	619
Maharashtra	315368	228147	87221	330	190	140	956	1201	623
Manipur	109506	82348	27158	125	95	30	876	867	905
Meghalaya	47715	35460	12255	85	65	20	561	546	613
Nagaland	16811	12080	4731	25	20	5	672	604	946
Orissa	231309	192986	38323	310	250	60	746	772	639
Punjab	158272	110708	47564	160	100	60	989	1107	793
Rajasthan	320470	259799	60671	320	230	90	1001	1130	674
Sikkim	47847	40532	7315	50	42	8	957	965	914
Tamil Nadu	375160	281662	93498	330	190	140	1137	1482	668
Tripura	112116	102665	9451	75	60	15	1495	1711	630
Uttar Pradesh	666195	536923	129272	630	450	180	1057	1193	718
West Bengal	512024	409297	102727	450	300	150	1138	1364	685
<u>Union Territories</u>									
Andaman & Nicobar Islands	33136	24441	8695	38	28	10	872	873	870
Chandigarh	11524	3237	8287	15	2	13	768	1619	637
Dadra & Nagar Haveli	15886	15886	-	10	10	-	1589	1589	-
Daman & Diu	6829	5127	1702	6	4	2	1138	1282	851
Delhi	79828	15999	63829	100	10	90	789	1600	709
Lakshadweep	8199	4497	3702	5	2	3	1640	2249	1234
Pondicherry	31164	15773	15391	35	15	20	890	1052	770
I N D I A	5947456	4632333	1315123	6022	4149	1873	1016	1144	728

Note: Sample Population/Average Sample Size for India excludes Jammu and Kashmir. The SRS is presently not in operation in Mizoram.

N.A.: Not Available.

- : No sample.

TABLE - 2

Trend in estimated vital rates - India, 1971-92

Year	Birth Rate			Death Rate			Infant Mortality Rate		
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
1971	36.9	38.9	30.1	14.9	16.4	9.7	129	138	82
1972	36.6	38.4	30.5	16.9	18.9	10.3	139	150	85
1973	34.6	35.9	28.9	15.5	17.0	9.6	134	143	89
1974	34.5	35.9	28.4	14.5	15.9	9.2	126	136	74
1975	35.2	36.7	28.5	15.9	17.3	10.2	140	151	84
1976	34.4	35.8	28.4	15.0	16.3	9.5	129	139	80
1977	33.0	34.3	27.8	14.7	16.0	9.4	130	140	81
1978	33.3	34.7	27.8	14.2	15.3	9.4	127	137	74
1979	33.7	35.1	27.6	13.0	14.1	8.1	120	130	72
1980	33.7	35.1	27.8	12.6	13.7	7.9	114	124	65
1981	33.9	35.6	27.0	12.5	13.7	7.8	110	119	62
1982	33.8	35.5	27.6	11.9	13.1	7.4	105	114	65
1983	33.7	35.3	28.3	11.9	13.1	7.9	105	114	66
1984	33.9	35.3	29.4	12.6	13.8	8.6	104	113	66
1985	32.9	34.3	28.1	11.8	13.0	7.8	97	107	59
1986	32.6	34.2	27.1	11.1	12.2	7.6	96	105	62
1987	32.2	33.7	27.4	10.9	12.0	7.4	95	104	61
1988	31.5	33.1	26.3	11.0	12.0	7.7	94	102	62
1989	30.6	32.2	25.2	10.3	11.1	7.2	91	98	58
1990	30.2	31.7	24.7	9.7	10.5	6.8	80	86	50
1991 ^②	29.5	30.9	24.3	9.8	10.6	7.1	80	87	53
1992 ^{②*}	29.0	30.7	23.1	10.0	10.8	7.0	79	85	53

* Provisional

② Excludes Jammu & Kashmir

Source: Sample Registration System

TABLE - 3

Sampling Variability of estimated vital rates

Year	Birth Rate			Death Rate			Infant Mortality Rate		
	Rate	s.e	prse	Rate	s.e	prse	Rate	s.e	prse
1968*	39.0	0.37	0.95	16.8	0.26	1.54	N.A.	N.A.	N.A.
1969*	38.8	0.32	0.84	19.1	0.34	1.81	N.A.	N.A.	N.A.
1970*	39.2	0.35	0.89	17.7	0.23	1.30	129	N.A.	N.A.
1975	35.2	0.22	0.61	15.9	0.17	1.06	140	N.A.	N.A.
1976	34.4	0.20	0.57	15.0	0.17	1.13	129	N.A.	N.A.
1977	33.0	0.23	0.69	14.7	0.16	1.07	130	N.A.	N.A.
1984	33.9	0.13	0.38	12.6	0.08	0.60	104	1.09	1.05
1985	32.9	0.13	0.39	11.8	0.08	0.71	97	1.44	1.18
1986	32.6	0.12	0.35	11.1	0.07	0.63	96	0.98	1.02
1987	32.2	0.12	0.39	10.9	0.07	0.64	95	0.99	1.03
1988	31.5	0.11	0.36	11.0	0.07	0.63	94	1.00	1.06
1989	30.6	0.12	0.38	10.3	0.07	0.64	91	0.98	1.08
1990	30.2	0.12	0.41	9.7	0.07	0.69	80	0.92	1.15

N.A. - Not Available

* For Rural area only.

Source: Sample Registration System

TABLE - 4

Correction Factors for Birth and Death Rates
1980-81 and 1985

State	Births		Deaths	
	1980-81	1985	1980-81	1985
Andhra Pradesh	1.0592	1.0033	1.0050	1.0000
Assam	1.0902	1.0379	1.0485	1.0379
Bihar	N.A.	1.0000	N.A.	1.0000
Gujarat	1.0107	1.0030	1.0251	1.0278
Haryana	1.0124	1.0112	1.0235	1.0220
Himachal Pradesh	1.0233	1.0132	1.0675	1.0190
Jammu & Kashmir	N.A.	1.0149	N.A.	1.0102
Karnataka	1.1106	1.0236	1.0644	1.0454
Kerala	1.0196	1.0043	1.0231	1.0154
Madhya Pradesh	1.0022	1.0025	1.0209	1.0000
Maharashtra	1.0251	1.0000	1.0465	1.0119
Orissa	N.A.	1.0098	N.A.	1.0214
Punjab	1.0196	N.A.	1.0142	N.A.
Rajasthan	1.0488	1.0252	1.1038	1.0227
Tamil Nadu	1.0198	1.0081	1.0138	1.0000
Uttar Pradesh	1.0233	1.0292	1.0514	1.0506
West Bengal	N.A.	1.0306	N.A.	1.0312
India	1.0316	1.0182	1.0336	1.0254

N.A. - Not Available

Source: Sample Registration System

IMPLEMENTATION CHART OF INDIAN SAMPLE REGISTRATION SYSTEM

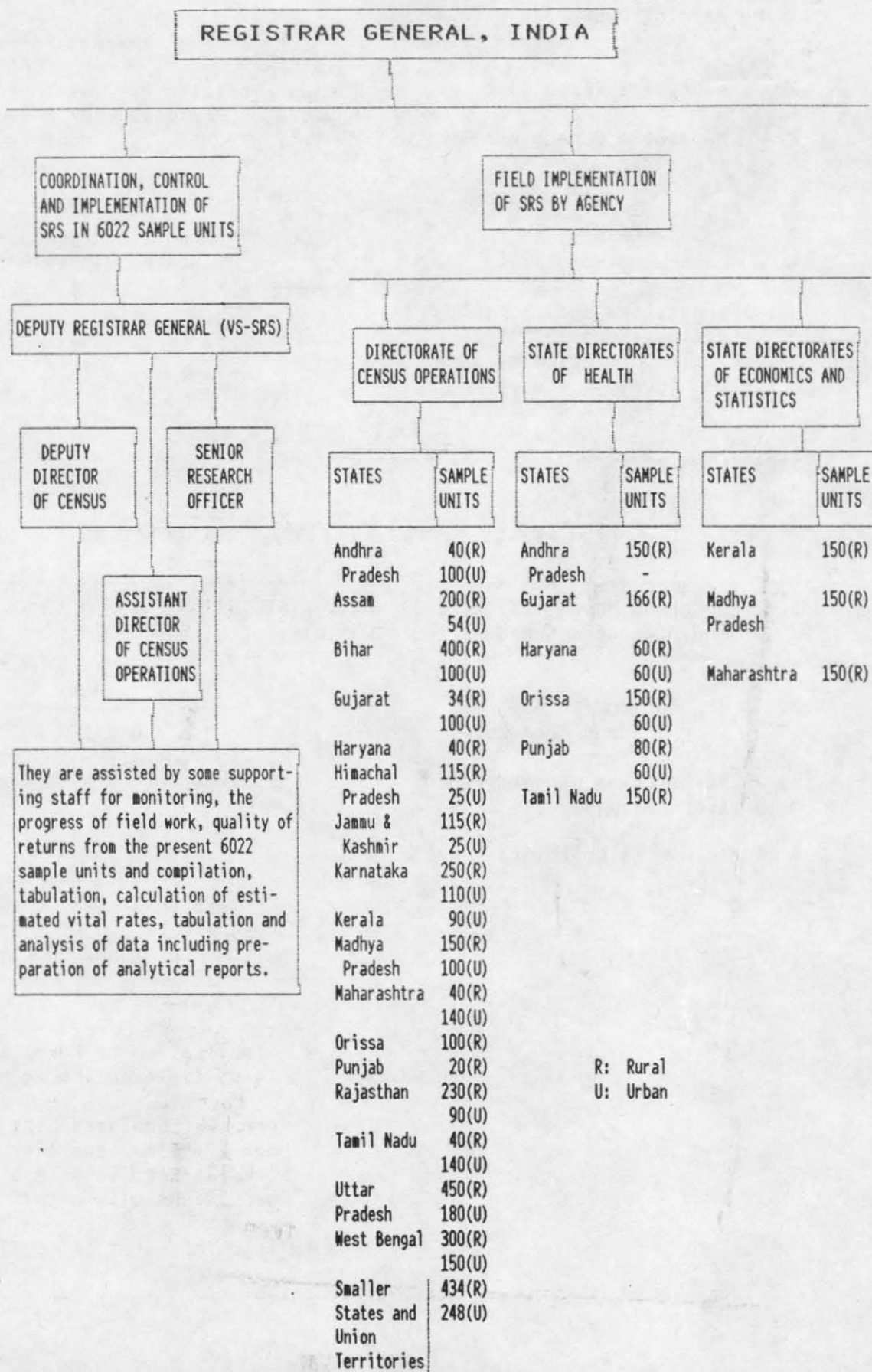


Figure 2

F L O W C H A R T

BASE-LINE SURVEY
(By Supervisor with the help of Enumerator)

CONTINUOUS ENUMERATION
(By Enumerator)

1. Houelist (Form 1)
2. Household Schedules (Form 2)
3. List of Pregnant women (Form 3)
4. Base-Line Population
 - (a) By age, sex and marital status (Form 15)
 - (b) Female population by age and level of education (Form 16)

BIRTHS	DEATHS
Births recorded by Enumerator (Form 4) Monthly Report Form 6	Death recorded by Enumerator (Form 5) Monthly Report Form 7

Consolidated Monthly Report (Form 8)
By States/UTs to ORGI

HALF-YEARLY SURVEY

1. Updating Houelist (Form 1) and Household Schedule (Form 2)
 2. Population for each HYS (Form 15 and Form 16)
 3. No. of ever married women (Form 17)
- Transmission to State/ORGI.

BIRTHS	DEATHS
List of births (Form 9)	List of Deaths (Form 10)

MATCHING
Births: Form 4 with Form 9
Deaths: Form 5 with Form 10

RE-VERIFICATION
(By third person or jointly by Enumerator and Supervisor)

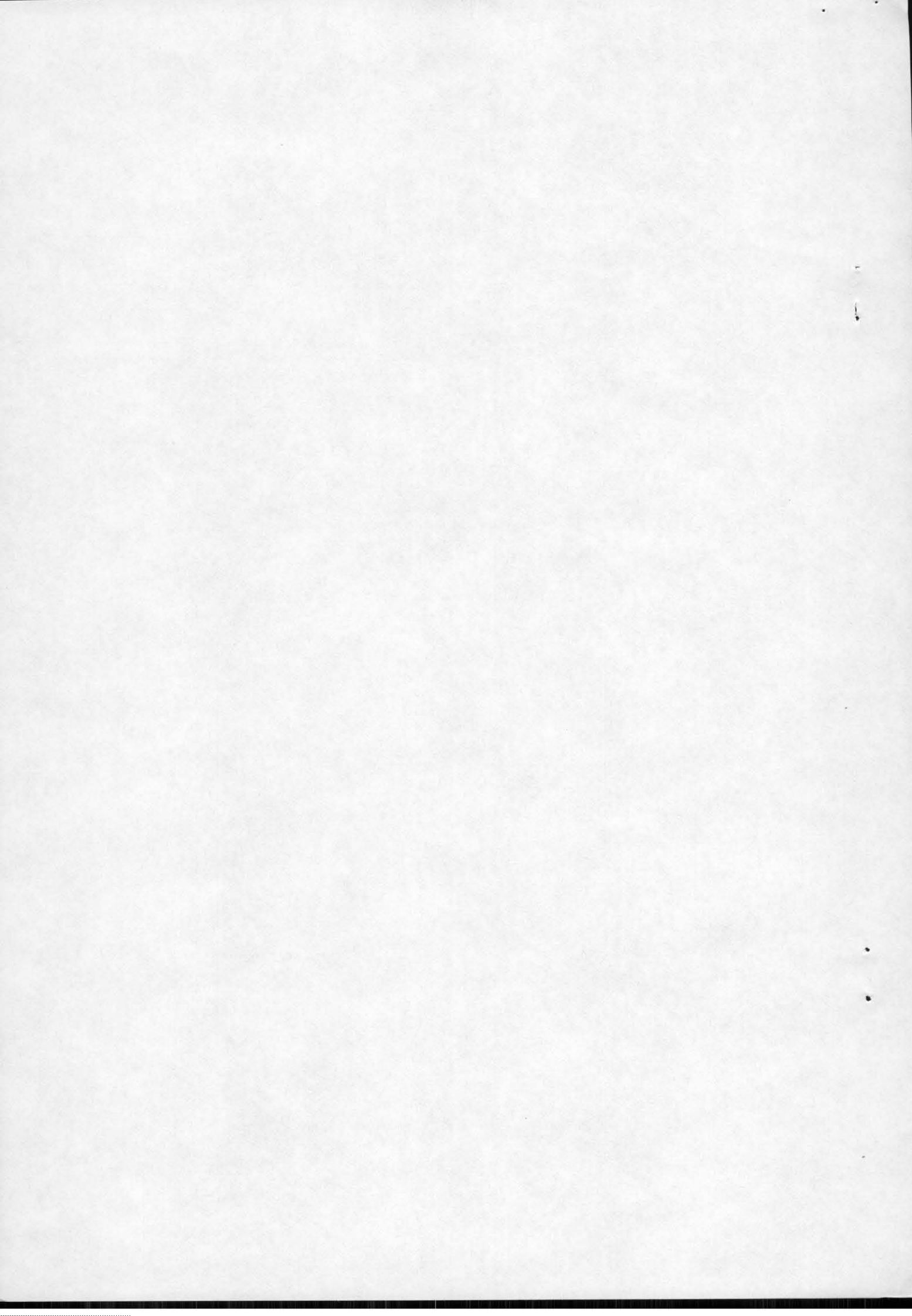
Finalisation of Forms 11 to 14 by implementing agencies

Form 11: Finalised List of Births
Form 12: Finalised list of Deaths
Form 13: Results of HYS for Births
Form 14: Results of HYS for Deaths

Transmission of Forms 11 to 17 to ORGI

A P P E N D I X - 2

(Estimation Procedure of SRS Vital Rates)



ESTIMATION PROCEDURE OF SRS RATES AND VARIANCES

RURAL AREAS

i = subscript for village/segments

j = subscript for stratum

k = subscript for natural division

n_{jk} = No. of sample villages/segments in the j^{th} stratum of k^{th} natural division.

N_{jk} = Total no. of villages in the j^{th} stratum of k^{th} natural division.

J_k = No. of stratum in k^{th} natural division.

K = No. of natural division in the state.

p_{ijk} = Sample population of i^{th} village of j^{th} stratum in k^{th} natural division.

b_{ijk} = No. of live births in i^{th} village of j^{th} stratum in k^{th} natural division.

d_{ijk} = No. of deaths in i^{th} village of j^{th} stratum in k^{th} natural division.

d'_{ijk} = No. of infant deaths in i^{th} village of j^{th} stratum in k^{th} natural division.

ESTIMATION OF POPULATION, BIRTHS, DEATHS AND INFANT DEATHS

The estimates at stratum level are given below:-

$$\hat{P}_{jk} = \frac{N_{jk}}{n_{jk}} \sum_{i=1}^{n_{jk}} p_{ijk}$$

$$\hat{B}_{jk} = \frac{N_{jk}}{n_{jk}} \sum_{i=1}^{n_{jk}} b_{ijk}$$

$$\hat{D}_{jk} = \frac{N_{jk}}{n_{jk}} \sum_{i=1}^{n_{jk}} d_{ijk}$$

$$\hat{D}'_{jk} = \frac{N_{jk}}{n_{jk}} \sum_{i=1}^{n_{jk}} d'_{ijk}$$

The estimates at natural division level are shown below:-

$$\hat{P}_R = \sum_{j=1}^{J_R} \hat{P}_{jR}$$

$$\hat{B}_R = \sum_{j=1}^{J_R} \hat{B}_{jR}$$

$$\hat{D}_R = \sum_{j=1}^{J_R} \hat{D}_{jR}$$

$$\hat{D}'_R = \sum_{j=1}^{J_R} \hat{D}'_{jR}$$

The estimates at State level are as under:-

$$\hat{P} = \sum_{R=1}^K \hat{P}_R$$

$$\hat{B} = \sum_{R=1}^K \hat{B}_R$$

$$\hat{D} = \sum_{R=1}^K \hat{D}_R$$

$$\hat{D}' = \sum_{R=1}^K \hat{D}'_R$$

The estimates of birth, death & infant mortality rates at State level are calculated as under:-

$$B.R. = \frac{\hat{B}}{\hat{P}} \times 1000 = \delta \times 1000$$

$$D.R. = \frac{\hat{D}}{\hat{P}} \times 1000 = \eta \times 1000$$

$$I.M.R. = \frac{\hat{D}'}{\hat{B}} \times 1000 = \pi \times 1000$$

Variances and Covariances of Population, Births, Deaths and Infant Deaths

Variances

$$\hat{V}(P) = \sum_R \sum_j \left[\frac{N_{jR}(N_{jR} - n_{jR})}{n_{jR}(n_{jR} - 1)} \left(\sum p_{ijk}^2 - \frac{(\sum p_{ijk})^2}{n_{jR}} \right) \right]$$

$$\hat{V}(B) = \sum_R \sum_j \left[\frac{N_{jR}(N_{jR} - n_{jR})}{n_{jR}(n_{jR} - 1)} \left(\sum b_{ijk}^2 - \frac{(\sum b_{ijk})^2}{n_{jR}} \right) \right]$$

$$\hat{V}(D) = \sum_R \sum_j \left[\frac{N_{jR}(N_{jR} - n_{jR})}{n_{jR}(n_{jR} - 1)} \left(\sum d_{ijk}^2 - \frac{(\sum d_{ijk})^2}{n_{jR}} \right) \right]$$

$$\hat{V}(D') = \sum_R \sum_j \left[\frac{N_{jR}(N_{jR} - n_{jR})}{n_{jR}(n_{jR} - 1)} \left(\sum d'_{ijk}{}^2 - \frac{(\sum d'_{ijk})^2}{n_{jR}} \right) \right]$$

Covariances

$$\hat{C}(P, B) = \sum_R \sum_j \left[\frac{N_{jR}(N_{jR} - n_{jR})}{n_{jR}(n_{jR} - 1)} \left(\sum p_{ijk} b_{ijk} - \frac{\sum p_{ijk} \sum b_{ijk}}{n_{jR}} \right) \right]$$

$$\hat{C}(P, D) = \sum_R \sum_j \left[\frac{N_{jR}(N_{jR} - n_{jR})}{n_{jR}(n_{jR} - 1)} \left(\sum p_{ijk} d_{ijk} - \frac{\sum p_{ijk} \sum d_{ijk}}{n_{jR}} \right) \right]$$

$$\hat{C}(B, D') = \sum_R \sum_j \left[\frac{N_{jR}(N_{jR} - n_{jR})}{n_{jR}(n_{jR} - 1)} \left(\sum b_{ijk} d'_{ijk} - \frac{\sum b_{ijk} \sum d'_{ijk}}{n_{jR}} \right) \right]$$

Variances of vital rates

$$V(B.R.) = 10^6 \times V(s) = 10^6 \times V(B/P) \\ = 10^6 \times \frac{1}{P^2} [\hat{V}(B) + s^2 \hat{V}(P) - 2s \hat{C}(P, B)]$$

$$V(D.R.) = 10^6 \times V(r) = 10^6 \times V(D/P) \\ = 10^6 \times \frac{1}{P^2} [\hat{V}(D) + r^2 \hat{V}(P) - 2r \hat{C}(P, D)]$$

$$V(I.M.R.) = 10^6 \times V(r') = 10^6 \times V(D'/B) \\ = 10^6 \times \frac{1}{B^2} [\hat{V}(D') + (r')^2 \hat{V}(B) - 2r' \hat{C}(B, D')]$$

The standard errors of births, deaths and infant deaths are obtained as the square roots of these variances respectively.

URBAN AREAS

- \bar{l} = subscript for enumeration block.
- j = subscript for stratum.
- n_j = No. of sample enumeration blocks in the j^{th} stratum.
- N_j = Total no. of enumeration block in the j^{th} stratum.
- J = No. of stratum.

Estimates of population, births, deaths and infant deaths and their variances are calculated as done for rural areas.

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