

Research Article

Assessment of Completeness of Birth Registrations (5+) by Sample Registration System (SRS) of India and Major States

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Abstract

In absence of reliable civil registration system, sample registration system (SRS) beginning in 1970 is the only source of information that allows us not only to track MDG (U5MR, MMR etc) but also provides input to calculate HDI, measure gender gap, immature adult births and deaths. Since 2001, there has not been any attempt to examine the quality of Sample Registration System (SRS). In this context, present paper is an attempt to assess the quality of SRS data for India and for some major states of India. At country level death undercount by SRS seems to around 4.3% for male and 11.3% for female during 2001-10. The results also show that the national level during the decade 1991-2000, 2 percent births (nearly 0.5 million) went unrecorded by the system, while during the decade 2001-2010, 3 percent of the births (0.8 million) went unrecorded by the SRS.

Introduction

In India, the Births and Deaths Registration Act, 1969, provides for the compulsory registration of births and deaths. Although the number of registrations can be obtained by way of enumeration at a certain point of time (e.g. census and surveys), data relating to the number of births is collected on an ongoing basis by civil registration, which is also the only source for individuals to obtain a legal certificate of birth. Not being open source and being a highly guarded/protected system, such data requires evaluation from time to time. The present paper is an attempt to assess the quality of birth registration by the Sample Registration System (SRS) the methods at the national and state levels. The results at the national level show that during the decade 1991-2000, 2 percent births (nearly 0.5 million) went unrecorded by the system, while during the decade 2001-2010, 3 percent of the births (0.8 million) went unrecorded by the SRS. In India, the assessment of the fertility level of the population can be done through civil registration, the SRS, and various other sources, but in the absence of good quality of civil registration statistics, the SRS is the most reliable source to estimate the level of fertility in the Indian population. The Registrar General of India (RGI) started a scheme of 'sample registration of births and deaths in India: rural' in 1964-65 on a pilot basis. This scheme became effective on the full scale in 1969-70 and is usually known as the Sample Registration System (SRS). The SRS includes the collection of data through two different techniques: continuous enumerations and retrospective half yearly surveys tracked by the process of matching of two records and the subsequent field confirmation of unmatched and partially matched events. The Chandrasekaran-Deming methodology (1949) is used to cross-check the correction and completeness of events.

Despite the SRS adopting the dual recording system, the estimates of vital rates are not free from errors especially with regard to the completeness of death and birth records. The completeness of vital registration under SRS has been carried out by the RGI from time to time. Results of an investigation conducted in 1980-81 suggested an omission rate of 3.1 percent for births and 3.3 percent for deaths at the all-India level (India, Registrar General 1983b). It is essential to subject any

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demography data for validation. In the absence of any internal evaluation exercise, this becomes even more important. Unfortunately, since 1991 no direct attempt has been made to evaluate the completeness of the SRS. Several indirect methods are available to evaluate the completeness of death registration, namely Brass (1975), Preston and Hills (1980), Martin (1980), Bennett et al. (1981) and Bhat (2002) etc.

A study by Bhat (2002) used the generalized version of the Brass Growth Balance method which is applicable to populations that are not necessarily stable and are also open to migration. This study estimated the completeness of death registration in India for the decade of 1981-90 and found that 5 percent deaths among men and 12 percent deaths among women were missed by the SRS (Bhat 2002). Data for the periods 1971-80 and 1981-90 indicates an average omission of 7.5 percent births and 6.5 percent births respectively. Such omission of births has a serious implication for the estimation of fertility indicators. Data for the 1990s and the 21st century has not been put to such systematic scrutiny to find out the completeness of births registered by the SRS. This is significant especially because sample areas are completely changed after every census. The sample area was changed in 1994, then in 2004 and probably in 2014 too. Therefore the main objective of the present work is to carry out a systematic evaluation of the fertility data registered by the SRS for the periods 1991-2000 and 2001-2010.

Objective

Assessment of the completeness of birth registration after adjusting the completeness of death coverage in the SRS data in India and major states

Sources of data

The Registrar General of India initiated a scheme of 'sample registration of births and deaths in rural India during 1964-65 on a pilot basis, which later became fully operational during 1969-70. The SRS collects data using a dual record system which first enumerates events on a continuous basis and later verifies the same by conducting retrospective half yearly surveys. This is followed by the process of matching of the two records and the subsequent field verification of the unmatched and the partially matched events. We have used the percentage of deaths by age from the SRS, the percentage of population by age used for estimating the number of deaths, and the size of population by age and sex for India and the study states between 1991 and 2010. The office of the Registrar General and Census Commissioner has been conducting the census every ten years since 1881, the latest having been conducted in 2011. We have used information on population by age and sex for three census populations in this study, that is, for 1991, 2001 and 2011.

(1)-SRS Statistical Report 1991-2011, CBR and CDR from SRS 1996 and 2006.

(2)-Census of India 1991, 2001 and 2011.

Methodology

Estimation of Completeness of Death registration

By Bennett and Horiuchi (1981) are used to estimate the completeness of death registration by SRS and census. This method is basically the extension of the methodology given by Preston et al, (1980) with some modification which does not require the assumption of stability of population. For stable population Preston et al, (1980) employed the relationship:

$$N(a) = \int_a^{\infty} D^*(x) \exp[r(x - a)] dx \quad (1)$$

Here $N(a)$ is the population age a and $D^*(x)$ is the true number of deaths experienced by person aged x in the current population and r is the growth rate for stable population. If the completeness of death registration is constant at age a and above, then

$$D^*(x) = k.D(x) \quad \text{for all } x \geq a. \quad (2)$$

Here $D(x)$ is number of registered deaths to person aged x . Therefore from (1) and (2):

$$N(a) = k \int_a^{\infty} D(x) \exp[r(x-a)] dx \quad (3)$$

If we define,

$$\dot{N}(a) = \int_a^{\infty} D(x) \exp[r(x-a)] dx$$

Then the completeness of death registration can be estimated as $\dot{N}(a)/N(a)$, when the number of registered deaths by age, the number of living persons by age and the growth rate of the population are provided. More robust measure of completeness can be derived from cumulating $\dot{N}(u)$ and $N(a)$. Cumulation would tend to absorb some of the distortion resulting from age misreporting and differential registration and enumeration by age. So the general equation given by Bennette- Horiuchi which holds true for any closed population is:

$$\dot{N}(a) = \sum D(x) \exp \int_a^x r(u) du$$

Estimation of Completeness of Birth registration by balancing equation

r = Birth rate- Death rate

r = Growth rate

$$CDR^{\text{adjusted}} = k * CDR^{\text{SRS}}$$

K = correction factor for death under registration by SRS at the same time for same population.

$$CBR^{\text{estimated}} = r + CDR^{\text{adjusted}}$$

$$\text{Completeness of Birth registration by SRS} = CBR^{\text{SRS}} / CBR^{\text{estimated}}$$

Assumptions

- (1)- The Bennett and Horiuchi method is based on the assumption that the completeness of death registration (C) is constant across all age groups.
- (2)- If the completeness of registration of deaths is not constant across all age groups, then median is the best estimate of the overall completeness of death registration.
- (3)- It is assumed that the balancing equation population will be closed to migration.

Implementation of procedures

- (1) The total population by sex recorded by the census for the census years 1991, 2001 and 2011 has been used to estimate the total population of India and selected states for each inter-censal year using linear interpolation methods. This procedure gives the population for the periods of 1991-2000 and 2001-2010. But for estimating the SRS completeness of birth registration during the census period 1991-2000, the population of each year, that is, 2001, 2002 ... 2010 has been estimated using exponential growth rate and census populations 1991 and 2001.
- (2) Age distribution of population for each five year age group has been taken from the SRS for the respective years for estimating the population in each age group for every year.
- (3) Estimating the total deaths for each year: five year age groups by percentage of deaths for each year from the SRS and the estimated population of the corresponding year have been used.
- (4) By adding the total number of deaths in each year during 1991-2000 and 2001-2010, total deaths between the periods can be obtained for each age group.

(5) The percentage of deaths is not available under the SRS for the individual years before 1995. So we have taken the percentage of death by age group as available for the year 1996 and applied it for the inter censal period for computing inter censal deaths by age.

(6) For estimating the completeness of death registration, the population of two censuses by age and sex and the total deaths during the period has been used in MORTPAK, which gives completeness of death registration for each age group. The median value for all the age groups provides the completeness of death registration.

(7) Finally, we have estimated the deaths completeness and then adjust the death rate (CDR). Then we applied the balancing equation to estimate the birth rate (crude birth rate). Lastly we have taken crude birth rate (CBR) from the SRS and compare it to estimated crude birth rate (CBR) for India and major states.

Results

According to Bhat (2002), by using the generalized growth balancing method in India's SRS for the decades 1971-80 and 1981-90, results at the national level show that during the decade 1981-90, 5 percent of the deaths among men, 12 percent of the deaths among women, and about 7 percent of births were missed by the system. Further, it is estimated that the level of under-enumeration of deaths in the 1991 Census was more than that in the 1981 Census by 0.7 percent for males and 1.4 percent for females.

Table 1 shows the completeness of birth registration for India and some major states. At the national level, results show that during the decade 1991-2000, 2 percent births (nearly 0.5 million) were missed by the system and during the decade 2001-2010, 3 percent births (0.8 million) were omitted by the SRS. It may be noted that in Bihar, Tamil Nadu and Himachal Pradesh, more than 5 percent of births were missed in 1991-2000. In Uttar Pradesh, the omission was nearly 4 percent during the decade 2001-2010, while in the rest of the states, birth completeness was more than 96 percent in the same time period. Rajasthan and Bihar had fewer birth registrations compared to the rest of the states during the decade 1991-2000. During 2001-2010, completeness of birth reporting improved. At 95 percent and 96 percent respectively, Rajasthan and Bihar too performed better than in the previous decade of birth registration. The national level coverage of birth completeness by balancing equation is 98 percent for the decade 1991-2001 and 97 percent for 2001-2010. The analysis of the SRS data for the states of Tamil Nadu, Bihar and Himachal Pradesh indicates deterioration in the completeness of birth reporting as compared to the national level and as well as other states over time.

Conclusion

Since the 1970s, demographic parameters like fertility and mortality have been provided by the SRS, considered to be the most reliable source. From time to time, demographers have used indirect methods to examine the reliability of the SRS in terms of coverage of deaths and births. However, for the last one or two decades, such an exercise has not been undertaken. The present paper attempted to examine the coverage of events in the SRS using the commonly used Bennett and Horiuchi method. Due to the non-availability of migration data, it has not been possible to use the generalized method given by Bhat (2002). In the current attempt, we have first estimated the completeness of death registration, and then the completeness of birth registration using the simple balancing equation. During the last two decades, it may be observed that nearly 2-3 percent of births, that is, 0.5 to 0.8 million births were missed by the SRS. There is some variation across the states. It may be mentioned that the current estimate is arrived at with the assumption that the growth rate estimated by the census is correct and that we have estimated the coverage of deaths correctly to a large extent. More research is required once details of migration data are available, especially for the state level estimates.

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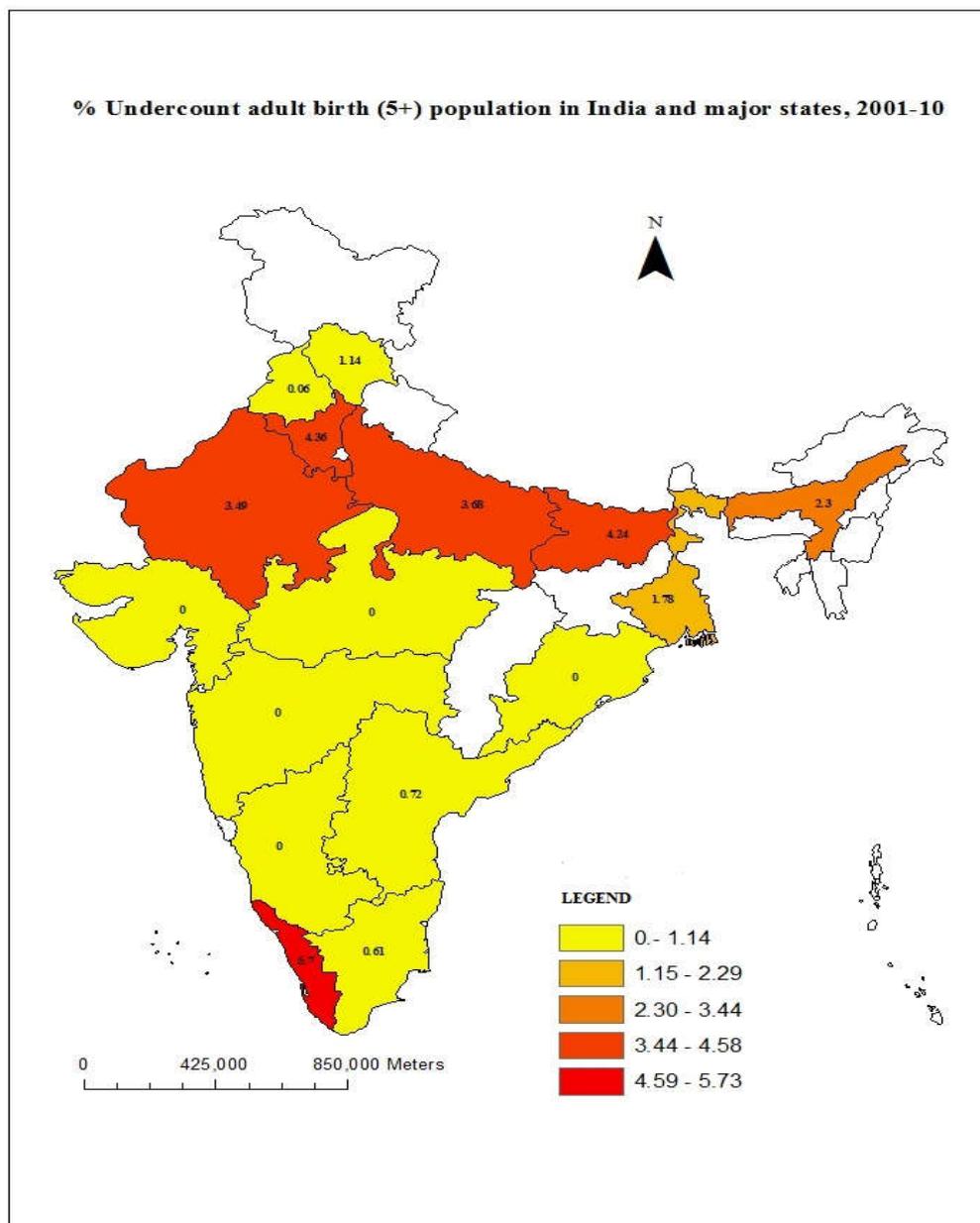
Table 1: % Undercount in births registration (5+) in total population by SRS in India and major states in 1991-2000 and 2001-10

| Country/States | Time | Births Undercount (%) |
|-------------------------|----------------|------------------------------|
| All India | 1991-00 | 1.62 |
| | 2001-10 | 2.69 |
| Andhra Pradesh | 1991-00 | 7.23 |
| | 2001-10 | 0.72 |
| Assam | 1991-00 | 5.21 |
| | 2001-10 | 2.30 |
| Bihar | 1991-00 | 6.15 |
| | 2001-10 | 4.24 |
| Gujarat | 1991-00 | 3.01 |
| | 2001-10 | 0.00 |
| Haryana | 1991-00 | 0.00 |
| | 2001-10 | 4.36 |
| Himachal Pradesh | 1991-00 | 5.36 |
| | 2001-10 | 1.14 |
| Karnataka | 1991-00 | 3.96 |
| | 2001-10 | 0.00 |
| Kerala | 1991-00 | 1.91 |
| | 2001-10 | 5.70 |
| Madhya Pradesh | 1991-00 | 2.17 |
| | 2001-10 | 0.00 |
| Maharashtra | 1991-00 | 0.00 |
| | 2001-10 | 0.00 |
| Odisha | 1991-00 | 2.17 |
| | 2001-10 | 0.00 |
| Punjab | 1991-00 | 0.33 |
| | 2001-10 | 0.06 |
| Rajasthan | 1991-00 | 1.92 |
| | 2001-10 | 3.49 |
| Tamil Nadu | 1991-00 | 10.59 |
| | 2001-10 | 0.61 |
| Uttar Pradesh | 1991-00 | 3.79 |
| | 2001-10 | 3.68 |
| West Bengal | 1991-00 | 2.72 |
| | 2001-10 | 1.78 |

*These states cover nearly 90 percent of all India's population in 2011 census

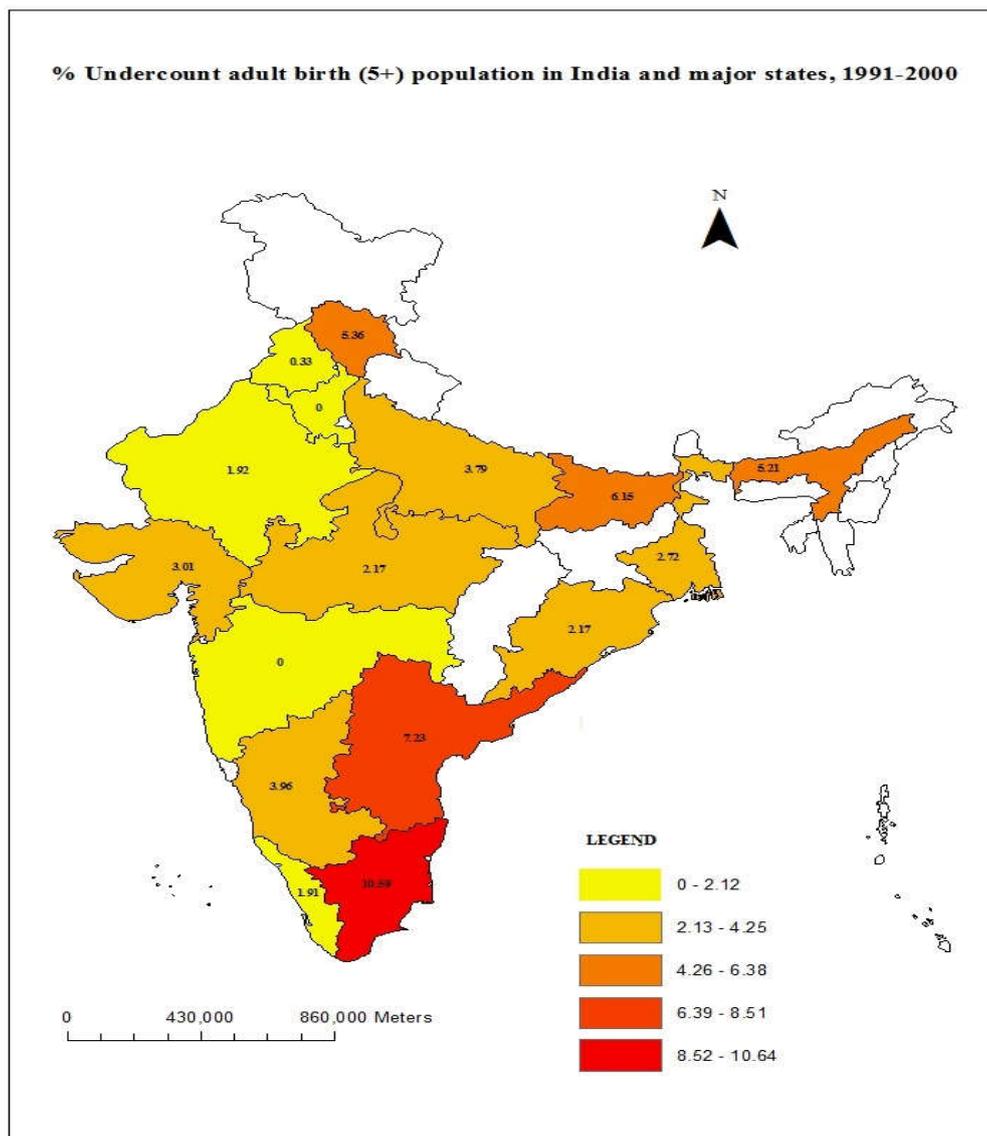
* Here 0.0 means 100% counting of adult (5+) births in SRS

Map 1: Show the (%) undercount (5+) of births registration in total population by SRS in India and major states in 2001-10



In this study we have taken only 16 major states i.e. Andhra Pradesh, Assam, Bihar, Gujarat, Rajasthan, Haryana, Punjab, Himachal Pradesh, Tamil Nadu, Kerala, Uttar Pradesh, West Bengal, Madhya Pradesh, Maharashtra, Karnataka, Odisha. The states which are blank have not been considered in this study because SRS don't give data for these states.

Map 2: Show the (%) undercount (5+) of births registration in total population by SRS in India and major states in 1991-2000



In this study we have taken only 16 major states i.e. Andhra Pradesh, Assam, Bihar, Gujarat, Rajasthan, Haryana, Punjab, Himachal Pradesh, Tamil Nadu, Kerala, Uttar Pradesh, West Bengal, Madhya Pradesh, Maharashtra, Karnataka, Odisha. The states which are blank have not been considered in this study because SRS don't give data for these states.