EXTENDED ABSTRACT

Measurements and Challenges of Adult Deaths Completeness in India and States: An Analytical study of different methodologies

Ajit Kumar Yadav[1], Prof. F. RAM[2]

Introduction

In India, the assessment of mortality level in population can be done through many sources of data like Civil Registration, Sample Registration System (SRS) etc. Since 2001, there has not been any attempt to examine the quality of SRS. Earlier study however have indicated major shortcoming in the system (Mahapatra, 2000). Completeness of events like birth and deaths do have large geographical challenges and also by sex, age (specially childhood). In this context, present paper is an attempt to assess the quality of SRS data and methods at national as well as state level. Registrar General of India initiated a scheme of 'sample registration of births and deaths in India: rural' in 1964-65 on pilot basis. This scheme became operational on full scale from 1969- 70 and is popularly known as Sample Registration system (SRS). SRS involves collection of data through two different procedure first, continuous enumerations and second, retrospective half yearly survey followed by the process of matching of two records and subsequent field verification of unmatched and partially matched events. This methodology provides a cross check on the correction and completeness of events. This procedure was developed by Deming & Chandrashekharannm "On a method of estimating birth and death rates and the extent of registration" (Journal of the American Statistical Association 44(245): 101-15. 1949).

Despite adopting the dual record system by SRS, the estimates of vital rates are not free from errors especially in context of completeness of adults' death and birth records. According to Bhat (2002), the omission rate is common in the registration system and even in census of developing countries and therefore it is necessary to check their completeness. In another study, Bhat (2002) had used the generalised version of Brass growth balance method which is applicable to the population that are not stable and also open to migration. This study estimated that during the decade of 1981-90, 5 percent of death among men and 12 percent death among women and about 7 percent of births were missed by SRS in India.

[1] Doctoral Fellow, International Institute for Population Sciences (IIPS), Mumbai, India Email: ajitkumaryadav1989@gmail.com
[2] Director, Sr. Professor International Institute for population Sciences (IIPS), Mumbai, India Email: framusha@gmail.com

The results at the national level show that, during the decade 1991-2000, 10 per cent of the deaths among men, 11 per cent of deaths among women, being missed by the system in decade 2001-10, 4 per cent of the deaths among men, 11 per cent of the deaths among women, being missed by the system.

Objectives

1. To examine the completeness of adults death registration by gender in India and four major states of India by Sample Registration System (SRS) for the period of 1991-2001 and 2001-11.
2. To assessment (e_5^0) of adjusted age specific deaths rate and SRS (e_5^0) age specific deaths rate for same period of time.

Data

(1)-Sample Registration System Statistical Report, 1991-2000 and 2001-11.

(2)- Census of India 1981, 1991, 2001and 2011.

Methodology

1. Brass (1975) this method is based on simple equality that holds true in any closed population (simple balancing equation):

$$r(x+) = b(x+) - d(x+) \quad (1)$$

Where, r(x+), b(x+) and d(x+) are the true rate of growth, birth and death for population above age x and over at some defined period. This method is known as **growth balance procedure.** Since the ratio of registered to true death is constant with age therefore,

$$d(x+) = d^*(x+)/c.$$

Where d*(x) is the registered death rate at age x and above. After substitution in equation (1), it becomes:

$$b^*(x+) = r + (d^*(x+))/c \quad (2)$$

2. Bennett and Horiuchi (1981) 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

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

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

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

If we define, $\tilde{N}(a) = \int_a^{\infty} D(x) \exp[r(x-a)]\, dx$

Then the completeness of death registration can be estimated as $\tilde{N}(a)$/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 $\tilde{N}(a)$ and N(a). So the general equation given by Bennette- Horiuchi which holds true for any closed population:

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

3. **Bhat (2002)** had used the generalized version of Brass growth balance method which is applicable to the population that are not stable and also open to migration.

Discussion

Results show in Table.1 completeness of adult deaths registration of India and major states. Rajasthan indicates that deterioration compared to the rest of the states noticeably for the female deaths completeness (82%) of reporting in decade 1971-80. In decade 1981-90 completeness of adult death reporting (85%) seems to have also worsened in the case of females of Rajasthan comparison of other states. In addition, in Table 2 the inclusion of data from Bihar for the decade 1991-2000 - where up to 14 per cent of female deaths were being missed - would have highest gender bias in this state and also male female difference is higher in this state by all different methodologies. In Rajasthan, 27 per cent of female deaths were being missed by SRS suggesting underreporting in this state but male female difference is higher in Uttar Pradesh by growth balance (robust) method (Table 3).

Table. 3 National level coverage of median deaths completeness by Bennett Horiuchi method in male (96%) and female (89%) is better estimates as compared to the growth balance (robust) estimates in male (79%) and female (73%) for same time period at national level. Table. 5 Show the difference between e_5^0 (Adjusted ASDR 1991-2000 & 2001-10 and SRS ASDR for same period of time). Life expectancy at age five that for some states SRS give over estimates and for some states SRS give under estimates compare estimated of life expectancy at age five. As the estimates of life expectancy at age five show, women did not

made significant gains in life expectancy over male in last four decades. The analysis of SRS data for states like Rajasthan, Bihar indicates that deterioration in the completeness of deaths reporting of female as compare to national level female deaths registration over period of time.

Table 1. Shows the summary of results from applications of the General Growth Balance method to data for major Indian states for the decade 1971-80 and 1980-91

India/States	1971-80			1981-90		
	Male	Female	Difference	Male	Female	Difference
Bihar	NA	NA	NA	0.90	0.80	0.1
M.P.	0.97	0.99	-0.02	0.95	0.94	0.01
Rajasthan	0.89	0.82	0.07	0.94	0.85	0.09
U.P.	0.93	0.95	-0.02	0.95	0.86	0.09
India	0.94	0.93	0.01	0.95	0.88	0.07

Source: Population Studies, Vol. 56, No. 2 (Jul., 2002), pp. 119-134 **N.A.** Not available **M.P.** Madhya Pradesh **U.P.** Uttar Pradesh, **Difference:** Male Female difference

Table2. Completeness of death registration applications of the Brass Growth Balance (robust), Bennett-Horiuchi and Generalized Growth Balance Method to data for Major Indian states for the decade 1991-2000

India/States	GBM (robust) 1991-2000			B-HM (MEDIAN) 1991-2000			MARI-BHAT (1991-2000)		
	Male	Female	Difference	Male	Female	Difference	Male	Female	Difference
Bihar	1.1	0.86	0.24	0.92	0.78	0.14	0.77	0.57	.20
M.P.	1.19	1.11	0.08	0.89	0.99	-0.1	0.77	0.89	-12
Rajasthan	0.86	0.8	0.06	0.72	0.76	-0.04	0.61	0.62	-1
U.P.	1.02	0.9	0.12	0.85	0.90	-0.05	0.86	0.74	12
India	0.9	0.89	0.01	0.94	1.00	-0.06	NA	NA	NA

GBM: Growth Balance Method, **B-HM:** Bennett-Horiuchi Method, **MARI-BHAT:** Generalized Growth Balance Method,

Table3. Completeness of death registration applications of the Brass Growth Balance (robust) and Bennett-Horiuchi method to data for major Indian states for the decade 2001-10

India/States	Growth Balance Method (robust) 2001-10			Bennett and Horiuchi Method (Median) 2001-10		
	Male	Female	Difference	Male	Female	Difference
Bihar	0.87	0.79	0.08	0.92	0.81	0.11
M.P.	0.93	0.87	0.06	1.07	1.02	0.05
Rajasthan	0.82	0.73	0.09	0.89	0.83	0.06
U.P.	1.01	0.82	0.19	0.92	0.82	0.1
India	0.79	0.73	0.06	0.96	0.89	0.07

Table 4. Expectation of life at age five years by Sample Registration System, Major Indian states, 1971-80 and 1981-90

India/States	Expectations of Life at age five years (e_5^0)					
	1971-80 (e_5^0)			1981-90 (e_5^0)		
	Male	Female	Difference	Male	Female	Difference
Bihar	NA	NA	NA	57.9	54.8	-3.1
M.P.	56.9	57.5	0.6	58.8	59.5	0.7
Rajasthan	56	56.4	0.4	58.6	59.9	1.3
U.P.	57.5	56.9	-0.6	58.6	57.3	-1.3
India	57.3	57.8	0.5	59.4	60	0.6

Source: Population Studies, Vol. 56, No. 2 (Jul., 2002), pp. 119-134 **Difference:** Female Male difference

Table 5. Caparison of life expectation at age five years by adjusted age specific death rate and SRS estimates, Major Indian states, 1991-2000 and 2001-10

India/States	Expectations of Life at age five years (e_5^0)							
	1991-2000				2001-10			
	Male		Female		Male		Female	
	Adjusted(e_5^0)	SRS(e_5^0)	Adjusted(e_5^0)	SRS(e_5^0)	Adjusted(e_5^0)	SRS(e_5^0)	Adjusted(e_5^0)	SRS(e_5^0)
Bihar	54.9	62.6	56.4	61.8	64.9	65.5	63.3	65.4
M.P.	55.5	60.0	58.2	60.3	65.0	62.1	68.1	63.9
Rajasthan	64.9	61.6	65.5	63.9	64.9	64.6	69.5	67.7
U.P.	61.1	60.9	62.1	61.7	63.6	62.6	64.2	63.8
India	62.5	62.1	65.5	64.4	64.6	63.8	67.3	67.4

Source: RGI: 1996&2006, Sample Registration System, Abridged life table 1992-96& 2002-2006, office of RGI, Delhi

Conclusion: In absence of the efficient civil registration system in India Sample Registration System gives reliable estimate of vital events, but this has some problem regarding completeness in adult deaths. Given the limitation of estimates based on population sampling registration system estimated value must deviates from the true value. Therefore it is necessary to check the completeness of death registration over time. This study finds the gap in actual death and registered death of adults by SRS. Therefore from this study, it can be concluded that there is a need to review the SRS procedure and updating of adults deaths registration of sampled population in the dual record of registration and enumeration of the SRS; that will give better and more reliable estimates of adults deaths at national and states level by gender. On the whole it may be concluded that there is not incredible change in completeness of adult mortality situation over around last 40 years though slight gain in life expectancies is noticed. Thus the paper suggests for considering death completeness while estimating completeness of adult mortality situation or representing gender differential in completeness of adult mortality at any place.

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