CONTRACEPTIVE PREVALENCE RATES AMONG SCHEDULE TRIBE AND SCHEDULE CASTE IN EMPOWERED ACTION GROUP STATES

LAISHRAM LADHUSINGH, CHUNGKHAM HOLENDRO SINGH AND KHANGENBAM JITENKUMAR SINGH

INTRODUCTION

It is encouraging that close to 30 per cent of India's total population has lowered its fertility to replacement level (MoHFW, 2004)[1] and many states are set to achieve TFR of 2.1 by 2010 as stipulated in the National Population Policy, 2000. However, the serious cause of concern is that in the states of Rajasthan, Uttar Pradesh, Madhya Pradesh and Bihar, TFR is still above three and these states are closely followed by Orissa with a TFR of 2.5. This reflects the fact that there is an impending need for overall development in these states which are now categorized as EAG or Empowered Action Group. As an integral component of all round developmental effort, there is also the need for increasing couple protection rate. Current contraceptive use not only varies between the states but also between subpopulations within states. For increasing couple protection rate it is vital that all subpopulations, particularly, schedule tribe (ST) and schedule caste (SC) populations are also evenly covered by the Reproductive and Child Health (RCH) programme.

Service statistics used to be the main source of data for estimating contraceptive prevalence rate but there is hardly any provision to derive estimates for subpopulations. National Family Health Surveys (IIPS, 1992-93; 1998-99)[2,3] which provide data on state-wise representative sample has become an alternative to service statistics for the purpose of assessment of contraceptive prevalence at the state level. However, post-stratified samples belonging to ST and SC populations are too small to arrive at reasonable and stable estimates of

Laishram Ladusingh, Professor, Chungkham Holendro Singh, Research Scholar, International Institute for Population Sciences, Govandi Station Road, Deonar, Mumbai – 400 088 and Khangenbam Jitenkumar Singh, Consultant UNICEF Project Manipur, Imphal – 795 001.

contraceptive prevalence for these subpopulations, even at the state level. District level household RCH surveys covered 1000 households in each district of all states and Union Territories in the country. Though the state level aggregate sample size is quite high, the post-stratified samples of ST and SC populations are still not adequate enough for estimation of contraceptive prevalence. As a consequence, estimates of contraceptive prevalence based on the post-stratified samples representing ST and SC population will have a margin of error beyond the statistically acceptable range.

Under the circumstances of inadequate sample size representing subpopulations in state or district level demographic and health surveys, such as, NFHS and RCH surveys, the generation of statistics pertinent to smaller subpopulations has emerged as a pressing problem for program managers and policy makers. The reason being the requirement of basic demographic and program indicators for small areas or subpopulations for the purpose of resource allocation and monitoring of welfare programmes oriented for underprivileged subpopulations. Fortunately, there is a growing volume of literature on the statistical technique of small area estimation. The U.S. Department of Health, Education and Welfare[4] adopted small area estimation technique for the estimation of persons with disability.

Gonzalez and Hoza[5] applied the method for obtaining estimates of unemployment for all countries in the United States. Fay and Herriot[6] used James-Stein procedures to estimate per capita income for small places with population less than 1000 from the 1970 U.S. Census of Population and Housing. Model-based approach in small area estimation was employed originally by Battese et al[7] for predicting areas under corn and soybean in 12 countries of the state of lows in the U.S. More recently, Melec et al[8] proposed a nested model to provide estimate of probability of at least one visit to a doctor within the past 12 months of the 50 states and the District of Columbia in U.S. Islam[9] applied synthetic estimator of small area estimation for estimating contraceptive prevalence rates of 60 districts of Bangladesh using data from the Bangladesh Demographic and Health Survey (1993-94). Many methods exist for inference about small geographical areas and domains; the recent papers by Pfeffermann[10] and Ghosh and Rao[11] provided a thorough and excellent reviews. An earlier paper by Purcell and Kish[12] gave a historical perspective and more detail descriptions of some methods.

The consideration of this study is to utilize the advancement in statistical technique of small area estimation in order to meet the requirement of subpopulation assessment of contraceptive prevalence among ST and ST populations in EAG states.

Source of data

The present study is based on DLHS-RCH (2002-2004)[13] data. This nationwide district level survey conducted for the assessment of maternal and child health care adopts a multi-state stratified sampling design. Each district is represented by 1000 households on the average spread over 40 primary sampling units with rural-urban coverage of 7.3. Currently married, non-pregnant women were asked on current contraceptive status with specification of methods. Table 1 shows details of state sample size, post-stratified ST and SC and other subpopulations along with the respective sizes of current contraceptive user.

TABLE 1

Currently married ST and SC women and contraceptive use in EAG states

State	ST		SC		Total	
	No. of women	No. using contraceptive	No. of women	No. using contraceptive	No. of women	No. using contraceptive
Rajasthan	3412	1355	5303	2514	29392	15165
Madhya Pradesh	6135	2793	5299	2720	34415	19415
Chhatisgarh	3343	1429	1443	700	11556	6149
Bihar	484	133	5713	1372	31414	10949
Jharkhand	3768	648	1910	686	13857	5525
Uttar Pradesh	494	159	11663	3869	56625	23186
Uttaranchal	179	101	1169	624	8790	5107
Orissa	5095	2168	4077	2379	23094	13741

Source: DLHS-RCH: 2002-2004.

Methodology

The basic problem in assessment of contraceptive prevalence among ST and SC subpopulations is that surveys are generally not designed for this kind of estimation, rather are optimized for efficient estimation for district or state level. This relates particularly to the sample size. Having a small post-stratified sample for a specified sub-population, the only possible solution to the estimation problem is to borrow sample strength from mutually exclusive domains which cut across the small areas, in this case ST and SC populations. The criterion of choosing domains is that it should be highly correlated with the characteristics of investigations, which is contraceptive use in the present study. Residence, educational level, household standard of living, children ever born and age of women are correlated with contraceptive prevalence among currently married women.

Let w_{ij} denote the proportion of i^{th} subpopulation in the j^{th} category of the domain, such that

$$\sum_j w_{ij} = 1 \qquad \text{........ (1)}$$

further, let p_j be the contraceptive prevalence rates for the j^{th} category of the domain derived from the entire sample which includes the subpopulation, then a design-based synthetic estimator of contraceptive prevalence for the i^{th} subpopulation is defined as

$$p_{i.}^{syn} = \sum_j w_{ij} p_{.j} \qquad ...(2)$$

The estimator in (2) is synthetic because it involves amalgamation of estimates computed from a large domain which comprises the subpopulation. The prominent advantage of synthetic estimator is the potential in increasing stability of small area estimate by substantial variance reduction. However, a strong assumption of synthetic estimator is that the larger domain is homogeneous with respect to the quantity that is estimated. Violation of this assumption can lead to severe bias in subpopulation estimates. Bias reduction can be achieved by the use of composite estimator. A composite estimator is the weighted sum of direct estimator of subpopulation based on post-stratified sample and synthetic estimator. A composite estimator of i^{th} subpopulation is thus defined as:

$$p_{i.}^{com} = f_i p_i + (1\ f_i) p_i^{syn} \qquad ...(3)$$

where p_i is the direct post-stratified estimator and $f_i = n_i/N_i$, so that more weight is given to the direct estimator as the sampling fraction increases the estimator of variance of composite estimator works out to be

$$\mathrm{var}(p_i^{com}) = f_i^2\left[\frac{p_i(1-p_i)}{n_i-1} + (1-f_i)^2 \times \left\{\frac{1}{n}\sum_j \frac{n_j^2}{n_{.j}^2}\right\}\sum_j \frac{n_{ij}}{n_{.j}} k_{ij}^2 \frac{p_{ij}(1-p_{ij})}{(n_{ij}-1)}\right] \quad \text{......(4)}$$

$$\text{where, } k_{ij} = \frac{n\, n_{ij}}{n_{i.} n_{.j}}$$

Application

The composite estimator of small area estimation outline in the preceding section is adopted for contraceptive prevalence estimates for EAG states. Domains which cut across ST and SC populations are residence, education, age and children ever born. Contraceptive prevalence rate (CPR) is derived for each of these domains of estimation in order to assure the assumption of homogeneity of contraceptive use within domain stipulated in synthetic estimator, one of the components of composite estimator. Contraceptive prevalence rate differential by ST, SC and other subpopulations in EAG states, while using residence, education, age, household standard living index and children ever born, respectively, as the domain of small area estimation through composite estimator is shown in Table 2.

A clear pattern relevant for all the states of Orissa, Madhya Pradesh, Uttaranchal, Chhatisgarh, Rajasthan, Jharkhand, Uttar Pradesh and Bihar is that contraceptive prevalence is higher in the other or general subpopulation (i.e. whole state with SC and ST) compared to SC and ST subpopulations. The contraceptive prevalence rate depicted in Table 2 using residence as the domain of estimation reveal 64 (Orissa), 59 (Uttaranchal), 57 (Chhatisgarh), 59 (UP), 53 (MP), 44 (Rajasthan), 43 (Jharkhand) and 37 (Bihar) percent, for other population in EAG states in the order listed above, the highest for Orissa and the lowest for Bihar. The relative error of the estimate in percent ranges from 0.38 in Madhya Pradesh to 0.83 in Uttaranchal.

The next highest contraceptive prevalence rate following other population is among the SC population for the states of Orissa, Uttaranchal, Madhya Pradesh, Chhatisgarh, Rajasthan and Jharkhand, with accompanying estimates of 59, 57, 55, 52, 50 and 39 percent, respectively.

TABLE 2

Small area estimates of contraceptive prevalence among ST, SC and other sub-populations by domain

State		Resi	R.E.(%)	Edu	R.E.%	SLI	R.E(%)	Age	R.E.(%)	CEB	R.E(%)
Bihar	SC	31.98	0.32	29.61	0.35	29.10	0.36	31.71	0.34	32.82	0.32
	ST	33.96	0.09	26.62	0.12	25.93	0.12	34.04	0.09	35.17	0.09
	Others	36.99	0.67	35.42	0.71	35.23	0.71	37.01	0.67	36.94	0.67
Chhatisgarh	SC	52.32	0.32	51.86	0.32	50.90	0.33	52.33	0.32	54.39	0.30
	ST	48.32	0.51	49.39	0.52	47.29	0.53	49.49	0.51	49.57	0.52
	Others	57.39	0.65	57.13	0.68	57.83	0.69	57.05	0.63	56.82	0.64
Jharkhand	SC	38.50	0.39	36.58	0.42	35.86	0.42	37.38	0.41	39.34	0.39
	ST	32.57	0.50	34.06	0.48	30.52	0.53	36.51	0.45	36.44	0.45
	Others	44.28	0.81	44.25	0.85	44.76	0.85	43.87	0.81	43.72	0.81
Madhya Pradesh	SC	55.27	0.19	54.69	0.19	53.47	0.20	54.82	0.20	56.38	0.19
	ST	52.24	0.22	52.95	0.22	49.61	0.23	52.73	0.22	55.58	0.21
	Others	59.41	0.38	59.39	0.40	59.86	0.39	59.40	0.37	58.95	0.38
Orissa	SC	58.57	0.23	57.31	0.24	56.82	0.50	58.42	0.24	59.76	0.23
	ST	53.15	0.29	51.99	0.30	48.24	0.64	53.94	0.30	55.09	0.29
	Others	64.03	0.40	64.43	0.43	66.67	1.10	63.91	0.39	63.50	0.40
Rajasthan	SC	50.01	0.25	48.93	0.25	47.43	0.27	50.23	0.25	51.35	0.24
	ST	47.42	0.21	47.68	0.20	43.76	0.23	48.89	0.20	51.50	0.19

State		Resi	R.E.(%)	Edu	R.E.%	SLI	R.E(%)	Age	R.E.(%)	CEB	R.E(%)
	Others	53.96	0.47	54.05	0.48	54.41	0.47	53.86	0.46	53.61	0.47
Uttar Pradesh	SC	38.33	0.24	36.93	0.25	35.81	0.26	38.23	0.24	39.48	0.23
	ST	39.33	0.05	37.59	0.05	35.98	0.05	39.75	0.05	41.96	0.04
	Others	42.70	0.44	42.80	0.45	42.89	0.45	42.71	0.44	42.61	0.44
Uttaranchal	SC	56.97	0.34	56.87	0.35	55.05	0.36	57.12	0.34	60.66	0.32
	ST	57.26	0.13	57.70	0.13	57.73	0.13	58.17	0.13	59.44	0.13
	Others	58.78	0.83	58.78	0.84	58.83	0.84	58.77	0.83	58.67	0.83

Note: Resi- place of residence; Edu = Education of women; CEB=Children ever born to a woman; RE=Relative error of estimate.

For these six EAG states in order of magnitude the contraceptive prevalence rate among ST population have been found to be lowest with associated figures of 53, 57, 52, 48, 47 and 33 per cent respectively in Orissa, Uttaranchal, MP, Chhatisgarh, Rajasthan and Jharkhand. The per cent relative error ranges from 0.13 in Uttaranchal to 0.51 in Chhatisgarh. In the other EAG states, namely, Uttar Pradesh and Bihar contraceptive prevalence rate is higher among ST population than SC population. For these two states the contraceptive prevalence rates among ST populations are 39 and 34 per cent respectively, whereas among the SC population the contraceptive prevalence rate in these two states is 38 and 32 percent respectively. One can predict that contraceptive prevalence among ST and SC populations in the states of Uttar Pradesh and Bihar are almost at the same level with not much differential being noted in the two population social sub-groups. The relative error in CPR ranges from 0.05 to 0.32 percent.

The pattern of contraceptive prevalence differential among ST, SC and other populations in EAG states estimated using education, age and children ever born is similar as that of residence but there are nominal differences in the estimates of levels.

Discussion

This study highlights the statistical problem of inaccuracy and instability of estimate of subpopulations (i.e. ST, SC and other) characteristics directly using small post-stratified sample belonging to the subpopulations from demographic and health surveys which have been optimized at the national level. The paper also describes and reorients the technique of small area estimation for application to contraceptive prevalence estimates among ST, SC and other population groups.

The application of the composite estimator of small area estimation technique reveals a general pattern of contraceptive prevalence in EAG states, highest among the other general population ranging from 64 per cent in Orissa to 37 per cent in Bihar. Contraceptive prevalence rate is lowest among the ST population in most states, ranging from 59 percent in Uttaranchal to 35 percent in Bihar. There is not much variation in contraceptive prevalence rate among SC and ST populations within states, though there exist wide variation between states. Nearly 61 percent contraceptive prevalence rate for SC population is found in Orissa and Uttaranchal and lowest 33 percent in Bihar. It is observed that contraceptive prevalence is uniformly high in Uttaranchal and uniformly low in Bihar across the three subpopulations. The levels in the estimates of contraceptive prevalence across the EAG states differ marginally by domain characteristics that is the reason for nominally higher values for the estimates based on children ever born. The relative error of the estimates of contraceptive prevalence well within 1.5 percent signals statistical acceptability of the present estimate of contraceptive prevalence for EAG states.

It is imperative to pave the way for enhancing contraceptive prevalence rates among ST and SC populations at par with the general population to bring the EAG states within the contour of National Population Policy 2002.

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