ESTIMATES OF MATERNAL MORTALITY RATIOS IN INDIA AND ITS STATES A PILOT STUDY

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ESTIMATES OF MATERNAL MORTALITY RATIOS IN INDIA AND IT'S STATES
A PILOT STUDY

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ESTIMATES OF MATERNAL MORTALITY RATIOS IN INDIA AND ITS STATES - A PILOT STUDY

INTRODUCTION

Though India has made an appreciable progress in improving the overall health status of its population but it is far from satisfaction. The pace of decline of infant and child mortality on one hand and maternal mortality on the other hand has been quite low. There has been a secular decline in IMR and CMR until 1996 and thereafter stagnation in IMR. The decline in IMR was on account of the decline in post neo-natal mortality. The future decline is anticipated due to decline in neonatal mortality. The neonatal mortality is primarily consequences of endogenous factors, which are largely governed by the maternal causes and thereby call for the monitoring of maternal mortality ratio in the population.

The results of large-scale survey have however shown that there was no decline in MMR over time indicating an urgent public health concern. The complications of pregnancies and the births are found to be the leading causes of deaths and disability among women of reproductive age. The health problems of mothers and newborns arise as a result of synergistic effects of malnutrition, poverty, illiteracy, unhygienic living conditions, infections and unregulated fertility. At the same time, poor infrastructure and ineffective public health services is also responsible for low inadequate obstetric care. The exact ascertainment of the situation could be monitored with the availability of MMR estimate and causes of maternal deaths.

Bharti *et al*(2002) has conducted a study in Rural North –24 Praganas to estimates of MMR and its related causes to ascertain the epidemiological factors which were associated with maternal deaths.

The National Family Health Survey 1992-1993 (IIPS.1995) was the first to provide the national level estimate of MMR as 424 per 100,000 live births for the period two years preceding the survey. But due to the scanty sample size regional or state level estimates could not be produced and several indirect methods have been proposed for estimation of maternal mortality. (Graham et al, 1989) developed sisterhood method which makes use of the data collected from female respondents in a sample survey on the number of ever married sisters they had, the number who were not currently alive, and the number who died while pregnant, during childbirth or within six weeks after delivery. The sisterhood method cuts down the required sample size drastically because women generally have several sisters who could have been exposed to the risk of maternal mortality. The limitation with sisterhood method is that it generally underestimating maternal mortality because of omission of events in the survey (Stanton et al, 2000). Bhat et al. (1995) have developed an indirect procedure of estimating maternal mortality from sex differentials in mortality at reproductive ages. Sisterhood method was also used by Mari Bhat (1995) to provide levels and differentials in maternal mortality in Rural India. The estimate of maternal mortality ratio was estimated as 638 per hundred thousand live births in rural areas of India during 1982-86. This estimate was derived from SRS data on sex differentials in mortality in reproductive age. Further Mari Bhat (2002) updated these estimates for India and its major states for the period 1987-96. These indirect methods used for estimating maternal mortality ratio have their own limitations. The Office of the Registrar General of India (1999) has provided estimates of MMR for all India and its states. These estimates have, however, large standard errors and for some states the estimates are not good enough because of the inadequate sample size. Hence, it is desirable to have the estimates of MMR and its causes at state level to monitor the progress of the RCH programme particularly the Maternal and Child Care Programme. It is needless to mention that availability of such information would be of immense help for the planning of appropriate and effective strategies to reduce the maternal deaths in the country. With this view, Department of Family Welfare,

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Ministry of Health and Family Welfare, Govt. of India, commissioned a study to provide the estimate of MMR at national and sub-national level along with major causes of such deaths. It was proposed to carry out the study in two phases: first to conduct a pilot study to develop the methodology and second to take up the main study. Accordingly, the Institute for Research in Medical Statistics, ICMR aimed to take up a pilot study to develop survey tools and instruments to estimate the level of MMR and ascertain the related causes of maternal deaths. It also proposed to try out various options of data collection and examine the feasibility of these options in varying field conditions. Keeping in view of methodological issues, the pilot study was designed in five states of India namely Uttar Pradesh, Karnataka, Uttranchal, Maharashtra and Delhi The present report presents the findings of the pilot study and provide an analytical view of various approaches of data collection based on the field study. Specifically it aims to capture maternal deaths as compared to house-to-house survey and the estimates of MMR in above five states along with their standard errors and confidence intervals

OBJECTIVES OF THE STUDY

- To estimate the maternal mortality ratio at the state level.
- To study the medical as well as socio cultural causes of maternal mortality.

Before undertaking the main study, it was desirable to under take a pilot study to

- Develop and validate the survey instruments.
- Examine the feasibility of the proposed methodology.

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METHODOLOGY

Sample Size

India, the estimate of MMR varies from 400-407 per hundred thousands live births (RGI 1999). Assuming MMR of 400 per hundred thousand live births, a sample of 3.8 lakhs live births was calculated to provide an estimate of MMR at all India level with 95% confidence level and less than 5% margin of error. Assuming a birth rate of 28.5 per thousand population, this would amount to covering about 1.30 crore population. This is based on the following formula

$$\text{Sample size (n)} = (Z_\alpha)^2 \, p \, q / \, d^2$$

Where Z_α = value of the standard normal deviate corresponding to Significance

$$p = \text{proportion (MMR)}$$
and d = permissible margin of error,

Selection of States and Primary Health Centres

 Having decided about the over all sample size, the total sample was allocated to different states taking into account the state specific MMR, birth rate and the population size. The precision desired at state level has also been considered.

 As in India Health System has a provision of Primary Health Centre (PHC) covering a population of about 30,000. This population was converted into number of PHCs in rural areas and (and UFS in urban areas), to obtain the number of births and maternal deaths in area covered

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under a PHC. So the ultimate sampling unit was a PHC. Proportionate sample has been taken from urban area, with UFS as the primary sampling unit.

Table 1 provides an allocation of total sample to different states. It would appear that this allocation would provide results at state level with different precision. For bigger states U.P, Bihar, M.P and Rajasthan the relative margin of error will be less than 5 per cent where as for smaller States Haryana, Punjab, J&K, Himachal Pradesh around 18-21 per cent For the northeast states the relative margin of errors would be less than 10 per cent and for the remaining States the relative margin of error would be about 20 per cent. In arriving at these, the population under a PHC has been assumed as 30,000 where as in actual practice it may be even more than 40,000. Delhi being the capital, comprise of health centers covering the population of 50,000 instead of 30,000. On the basis of pilot result obtained in U.P. states, a PHC has covered a population of about 40,000. Therefore, the precision of the results would be much more than assumed. .

In view of the above, the overall sample size works out to be 4.3lakhs live births (against 3.82 lakhs assumed) which would provide the overall results at 1% relative margin of error.

TABLE-1
STATEWISE ALLOCATION OF SAMPLE PHCs AND ASSOCIATED
MARGIN OF ERROR

STATES	BIRTH RATE	MMR	PHCs/ UFWs	BIRTHS	RELATIVE MARGIN ERROR
ANDHRA PRADESH	21.3	154	35	22365	22%
ASSAM	26.9	401	13	10491	8%
BIHAR	31.9	451	20	19140	5%
JHARKHAND	26.5	451	10	7950	7%
GUJARAT	25.2	135	45	34020	22%
HARYANA	26.9	196	15	12105	21%
HIMANCHAL PRADESH	21.5	196	25	16125	18%
JAMMU & KASHMIR	19.6	196	25	14700	19%
KARNATAKA*	22.0	217	30	19800	14%
KERALA	17.9	195	37	19869	16%
MADHYA PRADESH	31.2	498	15	14040	5%
CHHATISGARH	26.7	498	10	8010	6%
MAHARASHTRA*	22.0	183	40	25080	16%
ORISSA	24.3	361	20	14580	8%
PUNJAB	21.5	196	25	16125	18%
RAJASTHAN	31.2	677	10	9360	4%
TAMIL NADU	19.2	195	37	21312	16%
UTTAR PRADESH*	30.0	600	10	12000	4%
UTTARANCHAL*	20.2	297	18	12726	11%
WEST BENGAL	20.6	264	30	18540	11%
CHANDHI GARH	17.5	196	12	10500	22%
DELHI*	20.3	172	15	15225	23%
North East States	26.9	401	10	8070	9%
TOTAL (INDIA)	28.5	400	507	433485	1%

1. For computation of sample size following is assumed
 -MMR for Gujarat is about the level of Maharashtra.

 -MMR for Haryana, HP, J&K are at the same level as Punjab.

 - MMR for Tamil Nadu is about the level of Karnataka.
2. The actual population under PHCs would be much more than 30,000 and hence

 the precision would be higher with this sample of 507 PHCs.

3. The overall precision would be 1% as the number of births & population covered with

 State allocation is higher than calculated at All India level.

4. * BR & MMR are base on pilot study

The selected PHC was visited for collection of data on births and maternal deaths. Within selected PHCs, method of snowball sampling was carried out for identifying the maternal deaths as the rare event. For the enumeration of live births, house-to-house survey was done in addition to using snowball sampling. The reference period for maternal deaths and live births was three years (April 2000 to March 2003) preceding the survey. The causes of maternal deaths were assessed by verbal autopsy.

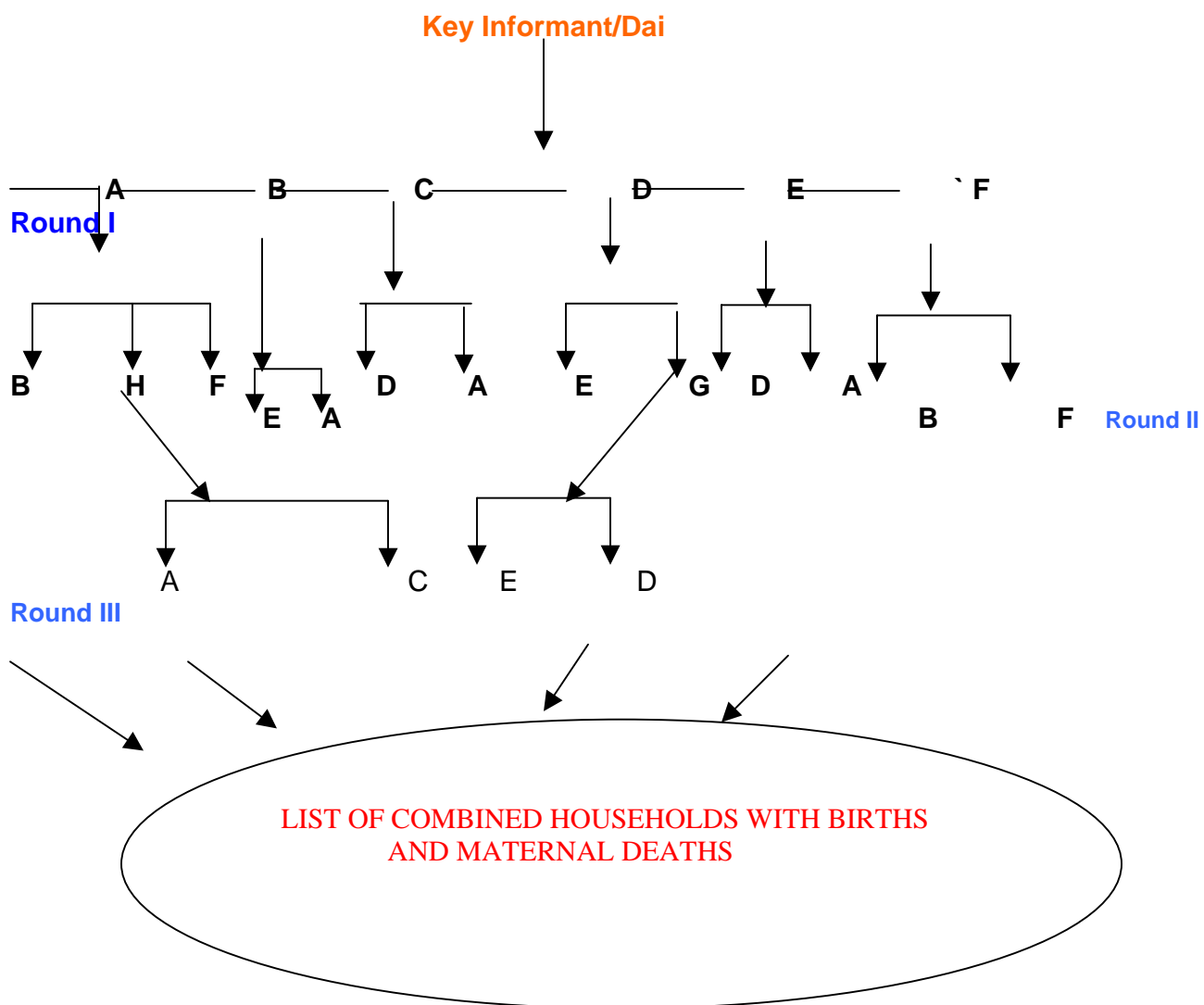**Snowballing methodology for data collection:**

Snowball sampling is a technique wherein we identify a few households where a maternal death occurred through some key-informants in the village and ask each of them to identify households where maternal deaths have occurred. The households where maternal death have occurred, were identified and asked to provide name of other households where similar event has occurred and so on. By this method of snowball sampling, all the maternal deaths are covered by contacting few related households.

The methodology was presented in the meeting chaired by the Secretary (FW), MOHFW and it was decided that initially study should be conducted on pilot basis in a few PHCs drawn in five from states namely UP, Uttaranchal, Maharashtra, Karnataka and Delhi. It was also suggested that before undertaking the pilot study, the study instruments prepared by IRMS should be pre tested in the field.

Survey Instruments: Five different types of instruments were prepared to collect the data for births and maternal deaths.
1. PHC Schedule
2. Sub- Centre Schedule
3. House to House Survey Schedule
4. Snowballing Schedule
5. Verbal Autopsy

FLOW CHART FOR SNOWBALLING
At village level

Key Informant/Dai

Round I

A   B   C   D   E   `F

Round II

B   H   F   E A   D   A   E   G D   A   B   F

Round III

A   C E   D

**LIST OF COMBINED HOUSEHOLDS WITH BIRTHS
AND MATERNAL DEATHS**

A, B, C, D………in round I are the households with particulars such as names, address etc, of the events as reported by the key informant as well as from the records at PHC/ Sub center.

OPERATIONAL FRAMEWORK OF PILOT STUDY

The following steps have been considered to carry out the pilot study

1. Selection of PHCs and Slums for Pre-testing and Pilot Study;
2. Pre – testing of the methodology and Instruments;
3. Presentation and discussion of pre-testing results;
4. Modifications in the methodology and survey instruments;
5. Pilot Survey.

These are discussed in what follows:

PRE- TESTING OF METHODOLOGY AND SURVEY INSTRUMENTS

Choice of PHCs and Urban Slums:

For validation of the methodology and the questionnaires developed for the collection of data, pre-testing was suggested in one slum each in Delhi and Kanpur district covering a population about 15000 and one rural PHC in Mathura district. Accordingly pre-testing was done in the Beri PHC of Mathura and in one slum area of Kanpur and Delhi each.
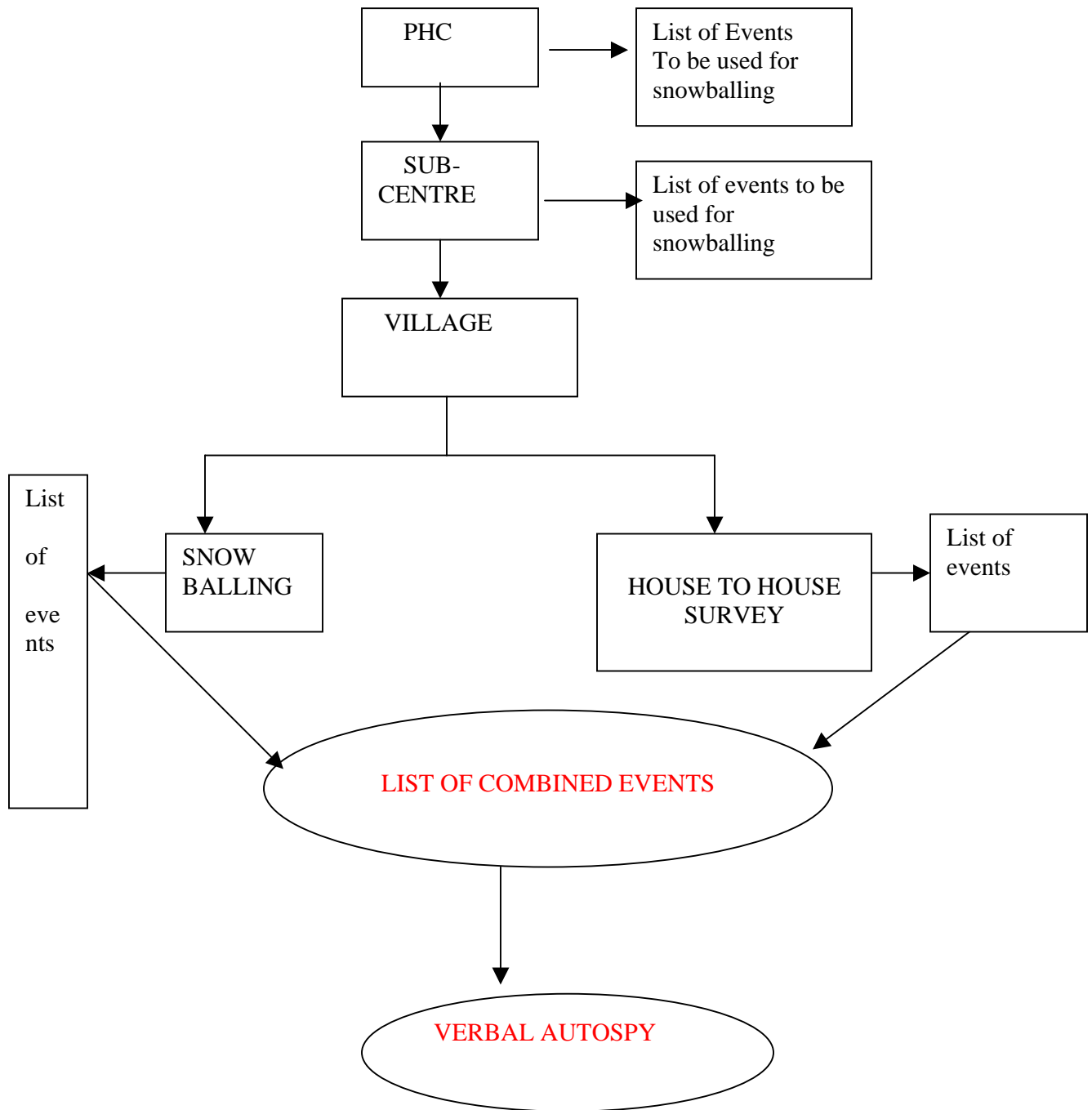
Process of Pre-Testing of Methodology & Survey Instruments:

Field teams consisting of field investigator and supervisors all for IRMS were trained for the processes of household listing, data collection and verbal autopsy interviews. They were also given field practice before sending in the field.

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Subsequently, the field team visited the selected PHCs. From the records available in the PHC, information on births and maternal deaths during the reference period were taken, and the list was prepared.

In each area of pre-testing, snowballing and house-to-house survey approach was followed for collection of information on maternal deaths and births. Two teams were employed for carrying out the fieldwork, one to carry out house-to-house survey and the other for snowballing. The teams worked independently. The reference period was 3 years preceding the survey i.e., March 2000 to April 2003.

OPERATIONAL FRAME WORK

```
        ┌──────────────┐                    ┌──────────────────────┐
        │     PHC      │───────────────────▶│ List of Events       │
        │              │                    │ To be used for       │
        └──────┬───────┘                    │ snowballing          │
               │                            └──────────────────────┘
               ▼
        ┌──────────────┐                    ┌──────────────────────┐
        │    SUB-      │───────────────────▶│ List of events to be │
        │   CENTRE     │                    │ used for             │
        │              │                    │ snowballing          │
        └──────┬───────┘                    └──────────────────────┘
               │
               ▼
        ┌──────────────┐
        │   VILLAGE    │
        │              │
        └──────────────┘
```

PHC

List of Events
To be used for
snowballing

SUB-CENTRE

List of events to be
used for
snowballing

VILLAGE

List of events

SNOW BALLING

HOUSE TO HOUSE SURVEY

List of events

LIST OF COMBINED EVENTS

VERBAL AUTOSPY

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Results of the pre-testing: The table 2 presents the demographic profile of the area covered in pre-testing.

Table –2 Demographic Profile

Indicator	Mathura	Kanpur	Delhi
Population covered	45778	15375	14770
Births	4555	987	937
Maternal deaths	28	7	2
Birth Rate	26	22	35
MMR	615	709	127

The following table presents the profile of Maternal Death in Pre-Testing

Table-3 Profile of Maternal Deaths - Pre Testing

Age Group	Mathura	Kanpur	Delhi	Total
<20	6	1		7
20-24	7	4	1	12
25-29	8		1	9
30-34	3	1		4
35-39	4	1		5
40+				
Total	28	7	2	37

Parity

0	5		1	6
1	6	4		10
2	2	1	1	4
3	7			7
4	3	2		5
5	4			4
6				
7	1			1
8				
9				
Total	28	7	2	37

Caste	Mathura	Kanpur	Delhi	Total
SC	8	1		9
OBC	6	4	2	12
Others	14	2		16
TOTAL	28	7	2	37

When did death Occur

Ante Natal	10	1	1	12
During Delivery		4		4
Post Natal	18	2	1	21
Total	28	7	2	37

Place of Delivery

Home	13	6		19
Institution	6		1	7
Not Delivered	9	1	1	11
Total	28	7	2	37

Delivery conducted by whom

	Mathura	Kanpur	Delhi	Total
Trained Dai	3			3
Untrained Dai	7	6		13
ANM/LHV	1			1
Nurse	2			2
Doctor	5	1	1	7
Others	1			1
Total	19	7	1	27
Place of Death				
Home	6	4		10
Institution	18	3	2	23
On the way to Hospital	4			4
Total	28	7	2	37

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Cause of Death

	Mathura	Kanpur	Delhi	Total
P.P.H.	6	2		8
Post Partum Septicemia	3	1	1	5
Anemia	5	1	1	7
Hemorrhage during pregnancy	2			2
Obstructed Labour		2		2
Retained Placenta	1			1
Hepatitis coma	1			1
Depression	1			1
Rupture uterus	1			1
Tetanus		1		1
Asthma	2			2
Food poisoning	1			1
HIV+	1			1
Accident	3			3
Suicide	1			1
Total	28	7	2	37

Salient observations

The experiences of the pre-testing of survey instruments done in one rural PHC of Mathura and in one slum each of Kanpur and Delhi were presented in the meeting held on 13 March 2003 in the MOHFW.   The following suggestions were made.

1. As the birth rate in slums and rural areas of U.P. is high, the total births during last three years together amounted to one-third of households reporting births. The snowballing of recorded births thus amounted doing house-to-house survey.

2. The house-to-house survey generally resulted in the under-enumeration of maternal deaths, which could be better covered through snowballing. It was because the information on maternal deaths was not revealed by some households for fear or otherwise. These were always reported by the key informants.

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In view of above, following suggestions were made.

➢ In high fertility states, house-to-house survey should be done for both births as well as maternal deaths.

➢ This has to be supplemented by snowballing approach for completeness of maternal deaths.

➢ Some questions required modification.

It was also suggested that the pilot study should be carried out in 8 PHCs, two each from the states of UP, Karnataka, Maharashtra and Uttaranchal. For urban area, one slum in Delhi and one in Kanpur might be covered. These suggestions were incorporated in the instruments and survey methodology for the pilot study.

PILOT STUDY

PILOT STUDY

Based on the experiences of pre-testing and suggestion made in the meeting, the survey instruments were modified by adding some new parameters namely information on place of delivery, parity, age of the mother during delivery, caste and literacy of the mother, as a part of the house-to-house survey instruments. In addition variables like socio economic, preparedness for delivery and health beliefs were also included in the verbal autopsy questionnaire.

The pilot study was conducted in five states namely Uttar Pradesh, Maharashtra, Karnataka, Uttaranchal and Delhi. These states were selected representing high MMR, medium and low MMR states. One district from each of these states was covered and from the selected districts, two PHCs from rural area and one UFS from urban area were taken.

Coverage

The following areas were covered in Pilot Study

Table 4- Coverage

State	District	PHCs (Rural)
Uttar Pradesh	Mathura Kanpur	Beri, Koshi Khurd Loharan Bhatti, Raja Purva….
Uttaranchal	Dehradun	Raipur, Sahiya
Maharashtra	Nasik	Girnare, Warkheda
Karnataka	Mandya	Kerakodu, Valagarahalli & Mandya town (urban)
Delhi (Slum)	Giri Nagar (Health Centre)	Nehru Place & Okhla Ph-I

Field Work: In addition to IRMS, the following Institute were involved in conducted the field work

Maharashtra: International Institute for Population Sciences (IIPS), Mumbai.

Karnataka: Population Research Centre, Institute for Social and Economic Change, Nagarabhavi, Bangalore

Delhi , Uttranchal and **UP** were covered by IRMS.

PROCESS OF PILOT STUDY

The study was carried out in 8 rural PHCs in the selected states and one urban slum each in Delhi and Kanpur in Uttar Pradesh. In each area of the pilot study, house-to-house survey approach was followed for the collection of information on births on the modified scheduled for household that includes additional variables like religion, caste, family size, income, education, place of delivery, delivery conducted by whom and maternal deaths. For capturing the maternal deaths, the house-to-house survey was supplemented by snowballing approach for the completeness of maternal deaths. Different teams were employed for carrying out the fieldwork, one for carrying out the house-to-house survey and the other for snowballing. The teams were trained and worked independently. The reference period was 3 years preceding the survey date from March 2000 to April 2003. The data analysis has been done separately for house-to-house and verbal autopsy schedules.

The demographic profile of pilot study with estimates of birth rate and MMR along with its standard error and confidence interval for the States/Districts were provided from the house-to-house schedule based on the area covered under the selected PHC in each states for MMR study. The details on socio economic variables and obstetric profile of the maternal deaths were provided from the verbal autopsy schedule.

Results: The following table presents the demographic profile with estimates of MMR and its standard error with confidence interval for the States/Districts based on PHC covered for MMR study.

Table 5 - Demographic Profile Pilot Study

State Name	Population Covered	Maternal Deaths (for 3 yrs)	Births (for 3 yrs)	Birth Rate (per 1000/yrs)	MMR Per 100,000	SE (MMR)	Relative Precision (MMR)	95% CI Lower	95% CI Upper
Uttar Pradesh	104495	57	9514	30	599	79	13.2	444	754
Uttranchal	74547	13	4377	20	297	82	27.6	136	458
Maharashtra	80928	10	5466	22	183	58	31.6	70	296
Karnataka	71744	9	4152	19	217	72	33.3	76	358
Delhi (Slum)	39766	5	2907	24	172	77	44.7	21	323
Total	**371480**	**94**	**26416**	**24**	**356**	**37**	**10.3**	**284**	**428**

It has been observed from the table that the overall relative standard error of the estimate of MMR is 10 per cent as assumed. The relative standard error for the states covered ranged from 28 to 45 per cent except Delhi, which may be lower for the main survey when more population will be covered.

The following table indicates the maternal deaths obtained by snowballing and House-to-House survey.

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Table-6

Details of maternal deaths: Snowballing and House-to-House Survey

State	Snowballing	House to house Survey
Uttar Pradesh	57	51
Uttaranchal	13	11
Maharashtra	10	10
Karnataka	9	7
Delhi(Slum)	5	4
Total	94	83

The above results shows that snowballing is more appropriate for capturing the maternal deaths.

HOUSING CHARACTERISTIC OF MATERNAL DEATHS:

The socio economic characteristics of the maternal deaths are presented in Table-7

Table – 7   Housing characteristics
Percent distribution of housing characteristic of maternal deaths

Electricity	%
Yes	64.6
No.	35.4
Source of drinking water	
Well	10.4
Hand pump	33.3
Tap water	47.9
Others	8.3
Drainage in front of the house	31.9
Open and stagnant	34.0
Open and running	4.3
Closed	29.8
No draining system	
Toilet facility	
Open field	93.7
Own pit	2.1
Others	4.2
Type of household	
Kutcha	20.8
Pucca	29.2
Semi Pucca	50.0
Separate room for kitchen	
Yes	52.1
No	47.9
Type of family	
Nuclear	65.3
Joint	34.7
Caste	
Schedule Caste	25.8
Schedule Tribe	11.8
Other Backward Caste	24.7
Others	37.6
Education of woman	
Illiterate	58.3
Literate (Primary onward)	41.7
Occupation of woman	
Housewife	85.4
Landless labour	6.3
Others	8.3
Number of maternal deaths	**94**

About 50 per cent of the maternal deaths were from semi pucca houses and 21 per cent from kutcha houses and remaining were from pucca houses. About 50 per cent

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houses do not have a separate kitchen in their houses. More than 90 per cent of the maternal deaths used open field for toilet. One third of the maternal deaths does not have electricity in their houses and uses hand pump as a source of drinking water. About 30 per cent of the houses do not have drainage system in front of their houses while 32 per cent of the houses had open and stagnant water system and 34 per cent open and running water systems. 65 per cent have a nuclear type of family. About 60 per cent of the maternal death women were illiterate and more than one fourth of the maternal deaths belong to schedule caste category and 12 per cent belong schedule tribe. More than 80 per cent of women were housewife. It has been observed from the above finding that most of the maternal deaths low socio economic standard and illiterate women living in unhygienic conditions, which may be the cause of maternal deaths.

Obstetric Care Services*:* Table-8 presents the obstetric care services of maternal deaths.

Table – 8   Obstetric Services Care

Variables	%
How far is the health facility	
<5 km	45.5
>5 km	54.5
Type of transport available	
Rickshaw	26.7
Van	20.0
No transport	13.3
Any other	40.0
Reason for not taken Treatment	
Due to inadequate transport	55.6
No male member was available	33.3
No money	11.1
Whether ANC taken	
Yes	67.0
No	33.0
Whether T. T. Vaccinations	
Yes	66.7
No	33.3
Whether Iron tablet	
Yes	53.5
No	46.5
No of days woman stayed in hospital before her death	58.6
1-2 days	24.2
3-4 days	17.2
4+ days	

From Table-8, more than fifty per cent of the respondent of the maternal death reported that the health facility were 4 to 5 km far from their houses and no transport facilities were found in about 14% of the cases. More than 55 per cent reported that due to inadequate facility of transport they could not take proper treatment. And about 15 per cent died on the way. It has been observed that in the hilly area of Uttranchal state, health facility was 40 km away from the village and there was no transport facility available in the village. One third of maternal death, women did not receive ANC care and same percentage did not receive T.T. vaccination. 47 per cent did not consume iron folic tablet during ante- partum period. It may be concluded that due to bad transport system and ineffective health facility may lead to inadequate obstetric care.

About 59 per cent woman stayed in the hospital for one to two days before the death. It indicates that after the delivery conducted at home by untrained dai woman got infection and rush to the hospital and died with in one or two days. It was also observed that the main cause of these maternal deaths was due to PPH.

Discussion on the profile of maternal deaths

The details of the maternal deaths observed is provided in Table-8

Table-9 Profile of Maternal Deaths –Pilot Study

Age Group	UP	Uttarnchal	Delhi	Maha-rashtra	Karna-taka	Total	Per cent
<20	9	1		3	2	15	15.96
20-24	18	2	3	6	3	32	34.04
25-29	16	5	1		4	26	27.66
30-34	5	3	0			8	8.51
35-39	8	1	0	1		10	10.64
40+	1	1	1			3	3.19
Total	57	13	5	10	9	94	100.00

Parity

1	8	2	1	3		14	14.89
2	11	2	1	3	6	23	24.47
3	9	2	2	1	3	17	18.09
4	10	2	0	2		14	14.89
5	19	5	1	1		26	27.66
Total	57	13	5	10	9	94	100.00

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Table-9contd….

Caste	UP	Uttarnchal	Delhi	Maha-rashtra	Karna-taka	Total	Per cent
SC	14	7		2	2	25	26.60
ST	0	1		8	2	11	11.70
OBC	20		2		1	23	24.47
Others	23	5	3		4	35	37.23
TOTAL	57	13	5	10	9	94	100.00

When did death occur

	UP	Uttarnchal	Delhi	Maha-rashtra	Karna-taka	Total	Per cent
Ante Natal	17	4	1	0		22	23.40
During Child birth	4	1	**0**	2		7	7.45
Post Natal	36	8	4	8	9	65	69.15
Total	57	13	5	10	9	94	100.00

Place of death

	UP	Uttarnchal	Delhi	Maha-rashtra	Karna-taka	Total	Per cent
Home	10	6		5	2	23	24.73
Institution	36	7	3	3	6	55	59.14
On the way to Hospital	11		2	2		15	16.13
Total	57	13	5	10	8	93	100.00

Place of delivery

	UP	Uttarnchal	Delhi	Maha-rashtra	Karna-taka	Total	Per cent
Home	29	7		7	1	44	46.81
Institution	12	2	4	3	7	28	29.79
Not Delivered	16	4	1		1	22	23.40
Total	**57**	**13**	**5**	**10**	**9**	**94**	**100.00**

Delivery conducted by whom

	UP	Uttarnchal	Delhi	Maha-rashtra	Karna-taka	Total	Per cent
Trained Dai	**4**	1		1		6	8.33
Untrained Dai	21	4		6	1	32	44.44
ANM/LHV	1	1				2	2.78
Nurse	3				1	5	6.94
Doctor	10	2	4	1	6	23	31.94
Others	2	1		1		4	5.56
Total	41	9	4	10	8	72	100.00

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Table-9 contd.

Cause of Death

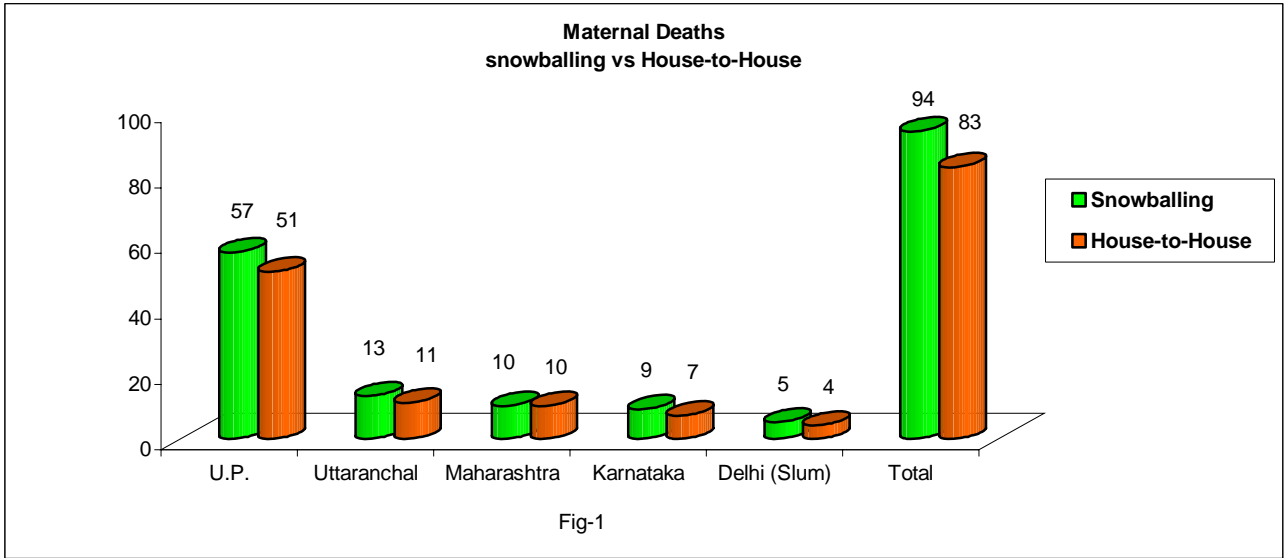|	UP	Uttarnchal	Delhi	Maha-rashtra	Karna-taka	Total	Per cent
P.P.H.	11	1		2	2	16	17.02
Post Partum Septicemia	7	2	1	2		12	12.77
Anemia	7	2	1		2	12	12.77
Hemorrhage during pregnancy	2	2	1			5	5.32
Obstructed labour	2	1				3	3.19
Retained Placenta	4			1	2	7	7.45
Eclampsica Ante Partum	0			1		1	1.06
Eclampsica Post Partum	1	1		2	2	6	6.38
Post Operation complication	2	1	1		1	5	5.32
Hypertensive disorder of pregnancy	0	1				1	1.06
Hepatitis coma	1			1		2	2.13
Depression	1			1		2	2.15
Rupture uterus	3					3	3.23
Embolism	1					1	1.08
Tetanus	1					1	1.08
Asthma	2					2	2.15
Food poisoning	1					1	1.08
HIV+	1					1	1.08
Accident	3					3	3.23
Non obstetric	6	1	1			8	8.60
Suicide	1					1	1.08
Total	**57**	**13**	**5**	**10**	**8**	**93**	100.00

- Cause for one maternal death could not be ascertain

It has been observed from the above table that 50 per cent of maternal deaths occurred before the age of 25 years of which 15 per cent had parity one and about 43 percent with parity three or more. About 48 per cent deliveries were conducted at home by untrained dais. About 69 percent of maternal deaths occur during postnatal period. It was observed that about 59 percent of the women died in hospital and 16 per cent died on the way. This may be due to the late referral of women to hospital by untrained dais.
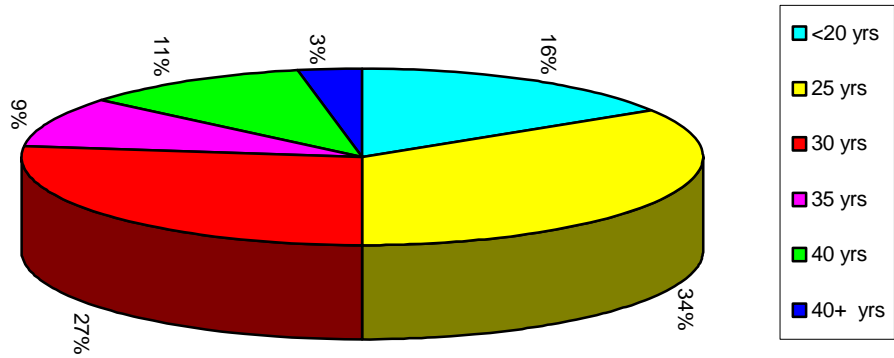
As presented in Table-9 the main causes of deaths were observed as post partum hemorrhage(17%) , septicemia and anemia (13%). It has also been observed that 7.5 per cent of the maternal deaths reported to be due to retained placenta and about 8.6 per cent due to non-obstetric reasons.
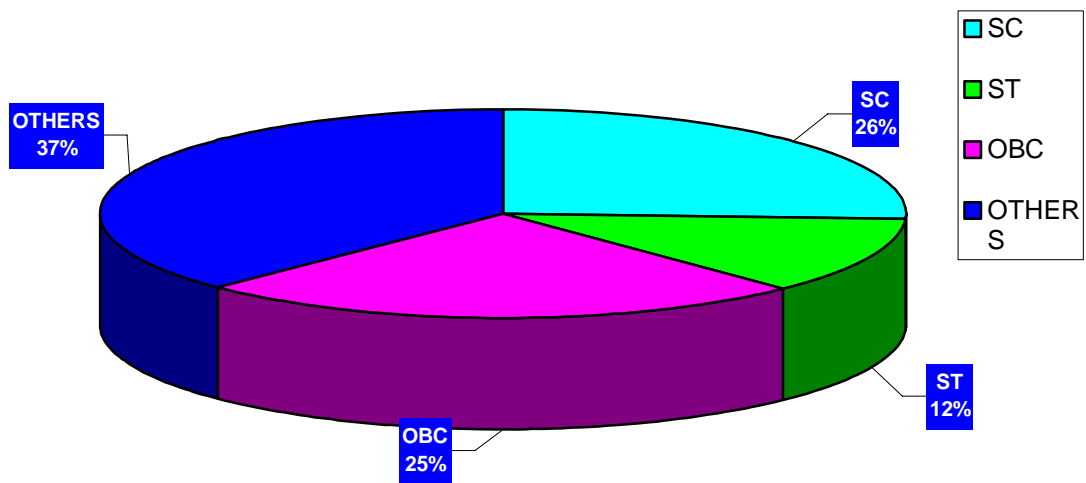
25

Summary

The study shows that snowball technique for capturing maternal deaths is feasible compared to House-to-House survey. It captures all maternal deaths, which are missed in the House-to-House survey. Pilot survey revealed that such omissions are over 10 percent. The estimates of MMR and birth rate for the states covered in Pilot Survey, though based on small samples, provide estimates comparable with these from other sources. The majority of maternal deaths occurred to women who were relatively young   and case of first delivery. This has programmatic implications /lessons.   More than three fourth of the maternal death occurred to the mothers below the age 30 years. More than 40% the deaths were at parity, one & two which may be due to early marriage age.

The main cause of death was observed to be PPH (17%), post partum septicemia (13%) and anemia (13%). About 24% of the deaths were observed to be during antenatal period, about 70% deaths in postnatal period and 7 % were found to be during delivery.45% of the deliveries were conducted by untrained dais. More than 60 percent of the maternal deaths occurred SC, ST and OBC households.
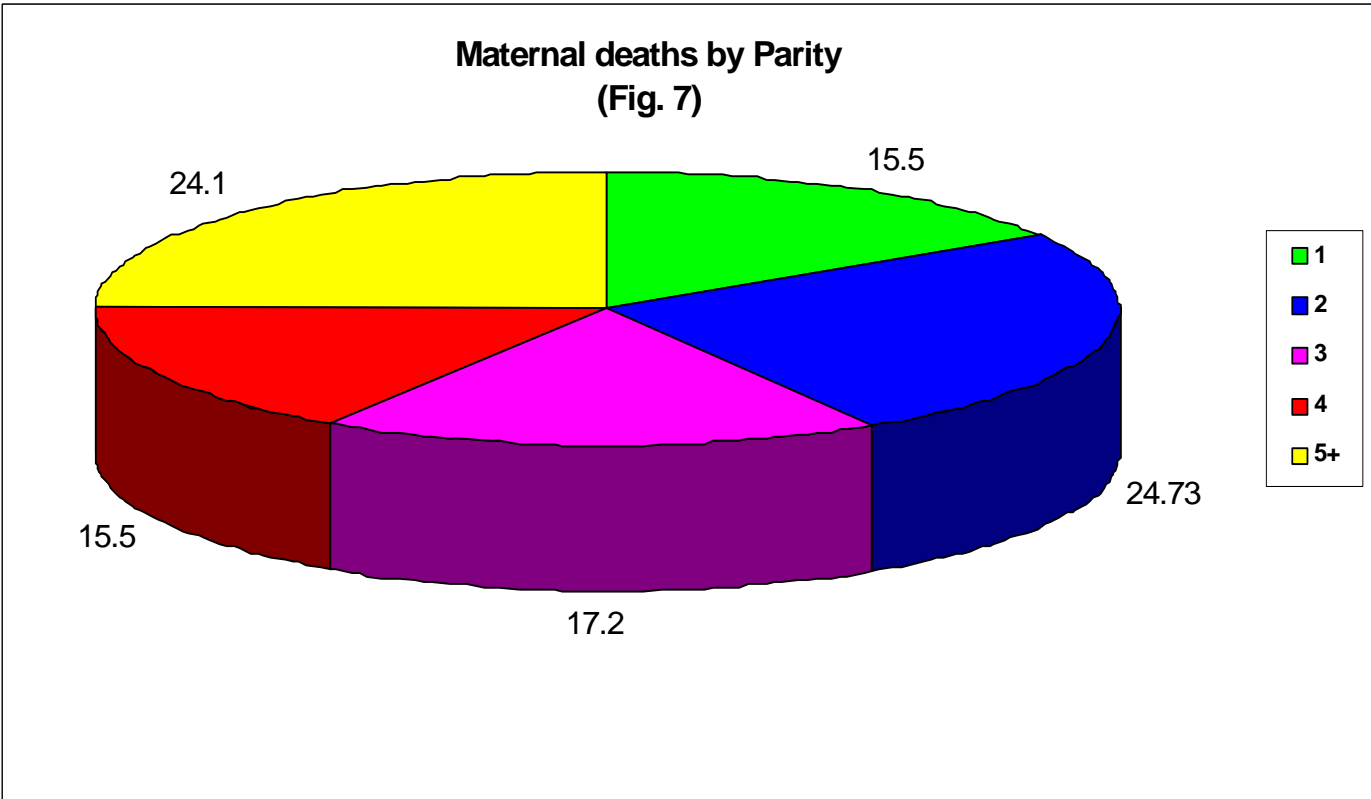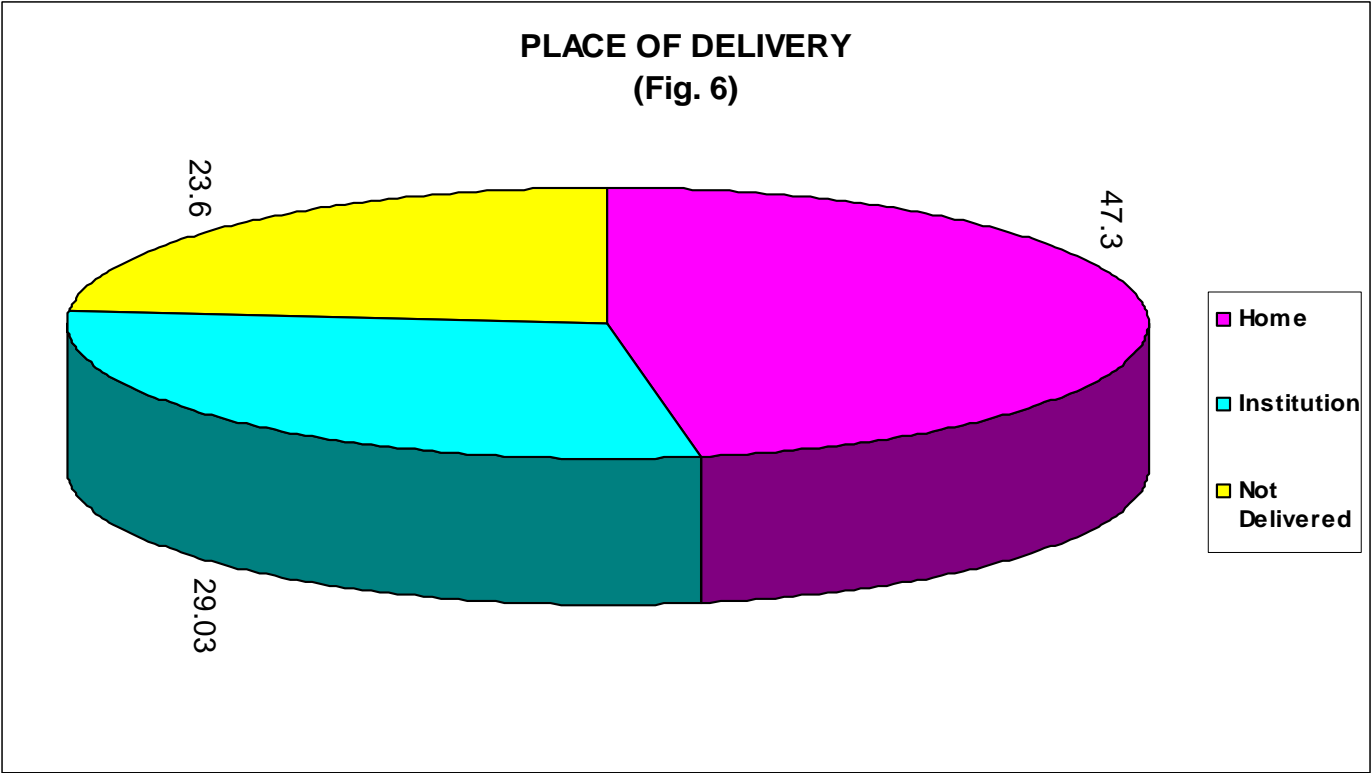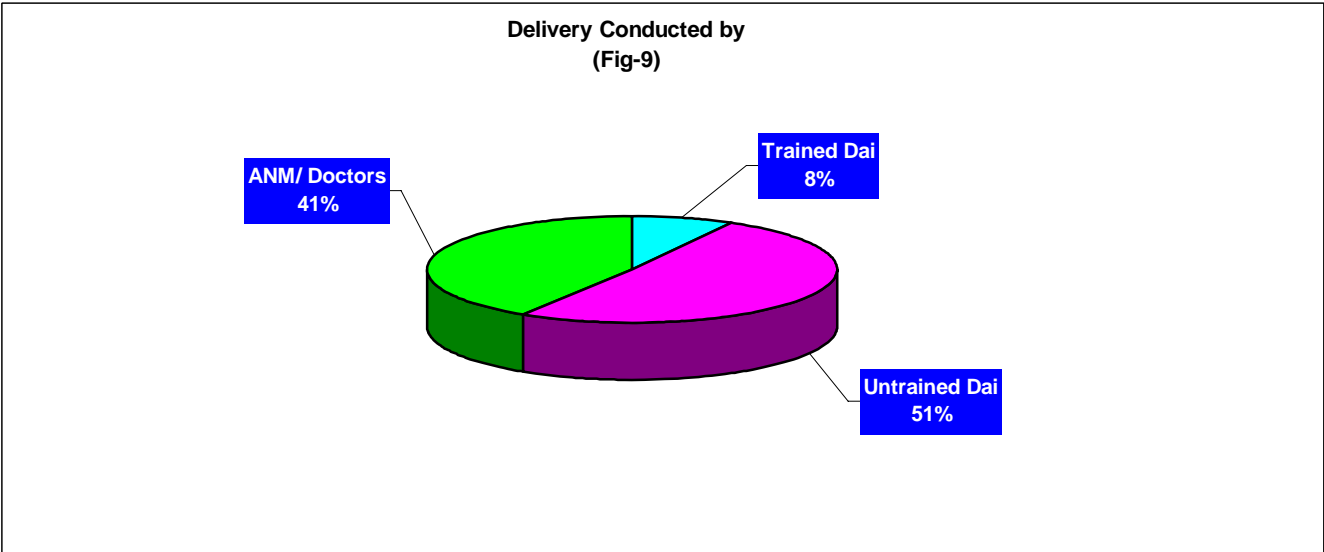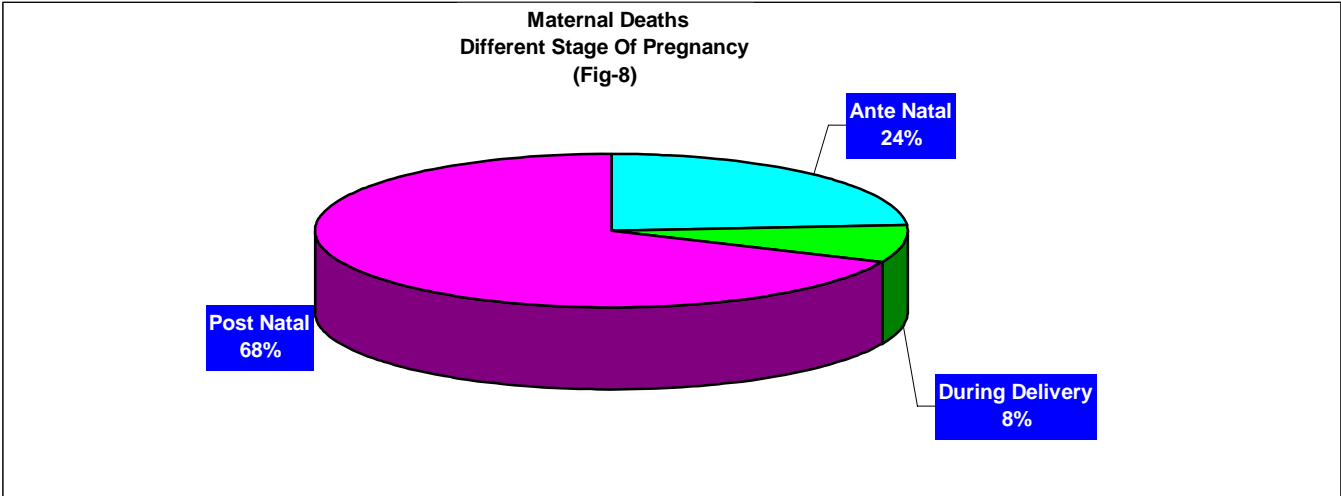
Maternal Deaths
snowballing vs House-to-House

Fig-1

Birth Rate

Fig-2

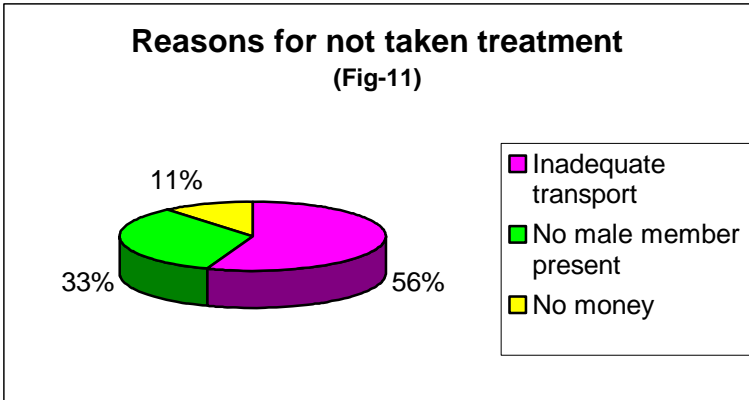**Maternal Mortality Ratio**

Fig-3

27
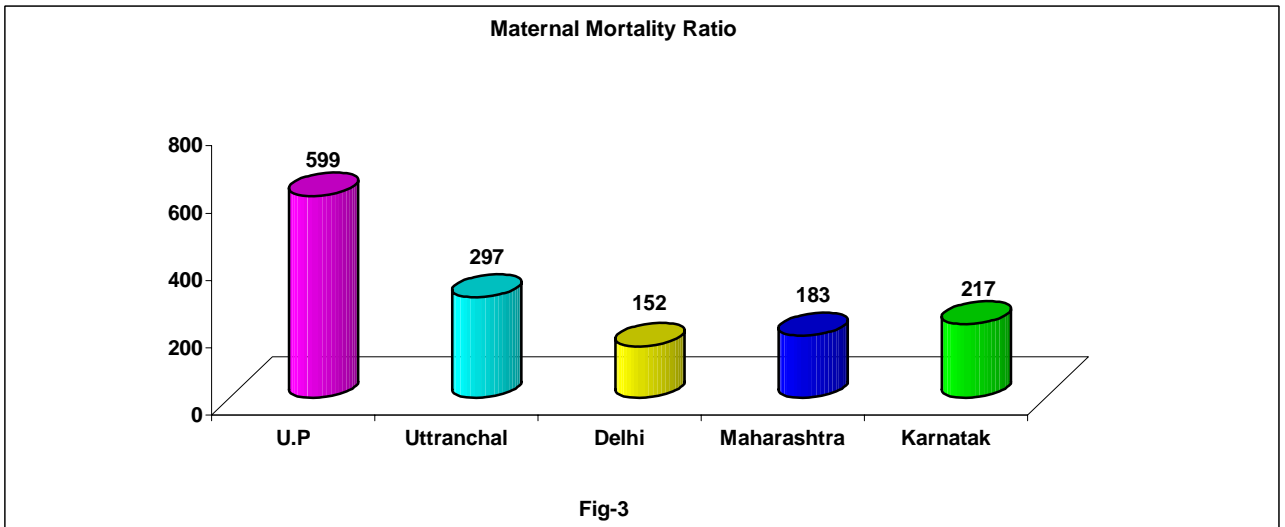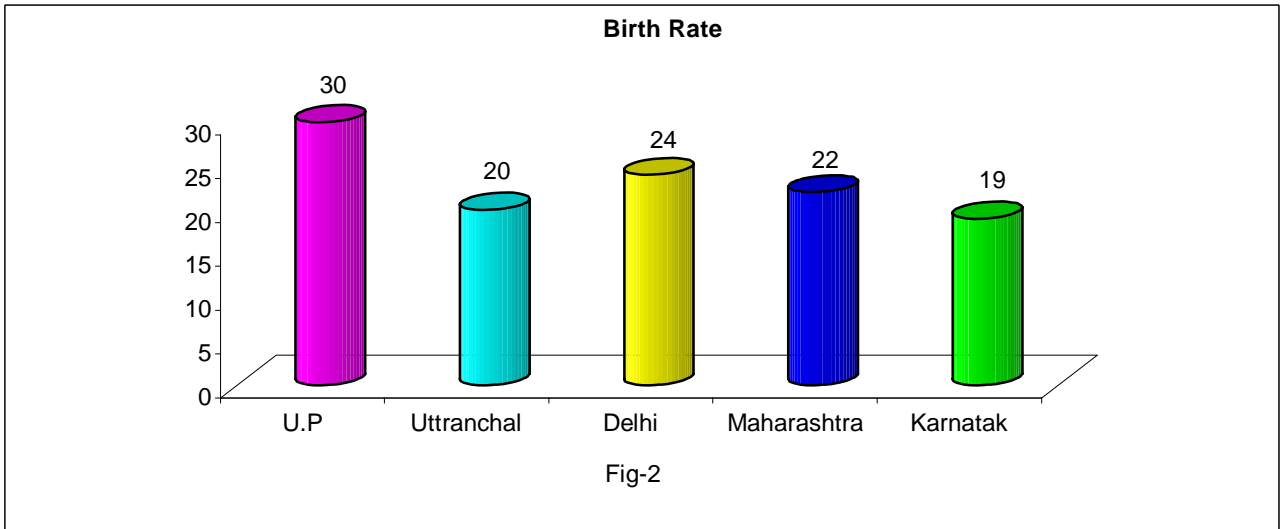
AGE DISTRIBUTION OF MATERNAL DEATHS
(Fig-4)

Legend:
- <20 yrs
- 25 yrs
- 30 yrs
- 35 yrs
- 40 yrs
- 40+ yrs

3%, 16%, 34%, 27%, 9%, 11%

Caste Distribution
(Fig-5)

Legend:
- SC
- ST
- OBC
- OTHERS

SC 26%, ST 12%, OBC 25%, OTHERS 37%

PLACE OF DELIVERY
(Fig. 6)

23.6

47.3

29.03

- Home
- Institution
- Not Delivered

Maternal deaths by Parity
(Fig. 7)

24.1

15.5

15.5

24.73

17.2

- 1
- 2
- 3
- 4
- 5+

**Maternal Deaths
Different Stage Of Pregnancy
(Fig-8)**

Ante Natal
24%

During Delivery
8%

Post Natal
68%

**Delivery Conducted by
(Fig-9)**

Trained Dai
8%

ANM/ Doctors
41%

Untrained Dai
51%

Cause of Death (Fig-10)

- Others 25%
- P.P.H. 17%
- Post Partum Septicemia 13%
- Anaemia 12%
- Haemorrage during Pregnancy 5%
- Obstructed labour 3%
- Retained Placenta 8%
- Non obstetric 17%

Reasons for not taken treatment
(Fig-11)
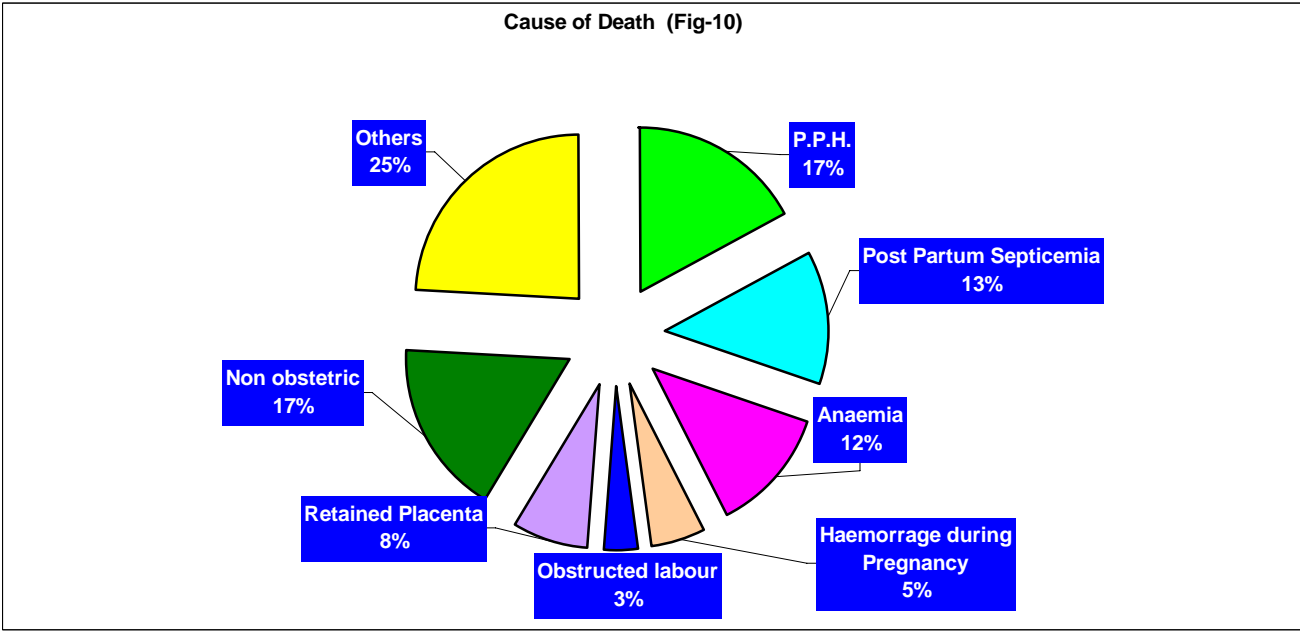
- Inadequate transport — 56%
- No male member present — 33%
- No money — 11%

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References:

1. Kwast B. et al. 1986. "Maternal mortality in Addis Ababa, Ethiopia" *Studies in Family planning* 17(6):288

2. Pal M., P. Bharati, T.S. Vasulu, A. Chaudhuri, B.N. Bhattacharya, R.N. Das and R. Ghosh. 2002. "Maternal Mortality in Rural North 24- Praganas, West Bengal: Estimation of its rate and Identifications of underlying Causes" *Demography India* 31(2):253-258.

3. Registrar General of India. 1990. "*Sampling Variability of SRS Vital Rates: 1984-86*". Occasional Paper No.1 of the Office of the Registrar General, India, New Delhi.

4. Registrar General of India. 1999. *Sample Registration System Bulletin* Vol.33 No.1. New Delhi: Office of the Registrar General, India, New Delhi

5. IIPS and ORC MACRO. 2000. *National Family Health Survey, India, 1998-99 (NFHS-2),* Mumbai: International Institute for Population Sciences.

6. IIPS. 1995. *National Family Health Survey, India 1992-93 (NFHS-1),* Mumbai: International Institute for Population Sciences*.

7. Martey J.O. et al. 1995. "Maternal mortality and related factors in Ejisu District, Ghana" *East African Medical Journal* December; 72(12): 774.

8. Mari Bhat, P.N. 2002. "Maternal Mortality in India: An Update" *Studies in family Planning,*33, 3:, 227-236.

9. Mari Bhat, P.N., Navvaneethan, K. and S. Irudaya Rajan. 1995. "Maternal Mortality in India: Estimates from a regression Model" *Studies in Family Planning*, 26(4):217-232.

10. Maternal Mortality in 2000: "Estimates Developed by WHO, UNICEF and UNFPA" *Report.*

11. Mbizvo M.T. 1993. "Maternal mortality in Rural and Urban Ziwbabwe: Social and reproductive factors in an incident case-referent study" *Social Science & Medicine* 36: 1197,

12. IRMS. 2002. Report on Estimates of Maternal Mortality in five States of India (2002*).* New Delhi: Institute for Research in Medical Statistics (ICMR).

13. RG.Walraven, M. Telfer, J Rowley & C. Ronsmans (2000) "Maternal mortality in rural Gambia: levels, causes and contributing factors", *Bulletin of the World Health Organization*, 78 (5).

14. Stanton, Cynthia, Nouureddine Abderrahim and Kenneth Hill. 2000. "An Assessment of DHS maternal mortality indicators" *Studies in Family Planning* 3(2): 111-123.