Child Mortality in Maharashtra

This article, based on a study by an alliance of NGOs called Child Deaths Study and Action Group (CDSAG), examines official statistics on child mortality rates in Maharashtra, juxtaposing them against the study's own findings, which also measured the extent and causes of under-reporting of child deaths in the state. It discusses the discrepancies discovered between official figures and the study report, especially in the neonatal mortality rates. It also looks at the causes of child deaths reported by the study through its 'social audit', which seeks to trigger social and political forces to embark on corrective administrative action to improve reporting and reduce child mortality in Maharashtra.

ABHAY BANG, M H REDDY, M D DESHMUKH

Every life counts.
So, count every birth, and
Account for every death.

–Brian MacArthy

I Introduction

A series of events at the grass roots level pointed towards the possibility of serious problems in the official statistics about child deaths in Maharashtra and raised questions with bearing on policy which led us to conduct this study.

(1) Gadchiroli is the least developed district in Maharashtra. Society for Education, Action and Research in Community Health (SEARCH) operates a vital statistics measurement system in nearly 100 villages in Gadchiroli since 1988, which regularly generates quality data on birth rate and child mortality which have been the basis of some internationally published field studies [Bang et al 1990, Bang et al 1999]. We observed a gross discrepancy in the infant mortality rate (IMR) recorded by us in Gadchiroli and the IMR reported by the health and family welfare (FW) department in the district. The district magistrate (collector) was asked by the state government to verify this (1997).

The collector selected one block (Aheri) in the district, collected information on births and child deaths during two months (April and August 1998), and then compared his findings with the child death rates reported for Aheri block by the health and FW department for the previous five years (1992-97), during April and August. He reported the following results to the government of Maharashtra: Though his methods of estimating child mortality rates were far from perfect, the district collector's report brought out a major problem. However, the collector was immediately transferred (October 1998).

	Health and FW Department	District Magistrate
Still birth rate	4	68
Infant mortality rate	13	118
< 5 years child mortality rate	20	168

(2) Though Maharashtra is an economically well-off state, newspapers frequently report episodes of increased number of child deaths in tribal areas. In the past decade, such incidents have been reported from Thane, Dhule, Amravati, Gadchiroli and Nandurbar districts. Since this is an issue of human rights as well as of the quality of governance, such reports have usually shaken the public conscience. Knowing this, the incumbent governments have responded by announcing emergency measures. However, the issue of child mortality was looked at as an aberration limited to a few tribal pockets and was managed in an ad hoc fashion. A public interest litigation filed in the high court resulted in a court order for a special scheme to prevent child deaths in the Melghat region, a tribal area in the Amravati district. Was the problem limited only to the tribal areas in the state? What was the situation in the rest of the state?

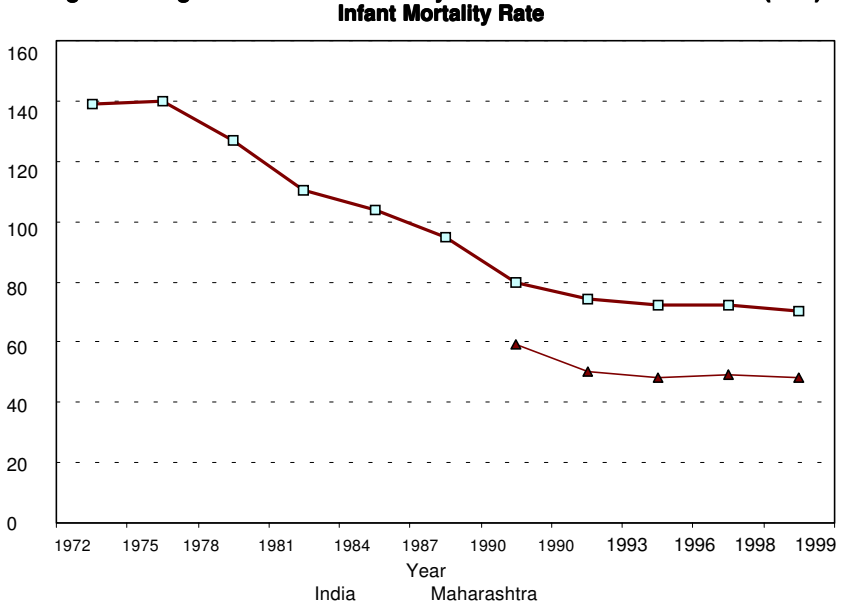
(3) It was disturbing that these episodes were always first reported by the newspapers. The management information system (MIS) of the health and FW department did not alert the administration on these episodes. On the contrary, when the national media was flooded with the reports about increased child deaths in the tribal district of Nandurbar, the district health office was reporting an IMR of 32, nearly half that estimated for rural Maharashtra by the sample registration system (SRS) [*The Week* 2001]. How reliable was the MIS of the health and FW department? How could the public health service in the state function properly without reliable reporting of child deaths by its programmes in operation?

(4) The goal of the National Health Policy (1983) and 'The Health for All' was to reduce the infant mortality rate to <60 per 1,000 live births by the year 2000. The official statistics, that is, the MIS of the government of Maharashtra and the SRS of the government of India showed that the goal had been achieved [GoM 2000, GoI 2000]. Was it true?

(5) The issue became especially important because the office of the registrar general of India has recently cautioned that, after a rapid decline during 1980-90, the IMR in India has stagnated since 1993 at the level of 72 [GoI 2000] (Figure1). This meant that the programmes which addressed the problem of child mortality (reproductive and child health programme, immunisation programme, ICDS) were no longer effective in further reducing the IMR, and a larger proportion of infant deaths were now contributed by neonatal deaths because this component is influenced little by the current programmes[GoI 2000a]. However, it is widely suspected that the real magnitude of neonatal mortality is not appreciated due to gross under-recording of neonatal deaths as well as still births [James et al 2000]. Is it true?

(6) The National Population Policy (2000) has set the goal to reduce the IMR

Figure 1: Stagnation of Infant Mortality Rate in India and Maharashtra (SRS)



Source: Annual report of the Sample Registration System, Government of India.

to less than 30 by the year 2010 [GoI 2000b]. Many states, including Maharashtra, have formulated a state population policy, with state-specific goals to reduce the IMR. In the absence of reliable information, how will the states know their progress towards this goal?

The grass roots events in Maharashtra appeared to be manifestations of a larger national problem of reliable estimates. The loss of credibility of the official statistics, especially in the 1990s, has led to the appointment of the National Statistical Commission. Its chairman, C Rangarajan, has succinctly summarised the national problem:

> A good statistical system is a prerequisite for sound decision-making and for the formulation and monitoring of public policies…What has brought about a decline in the quality and reliability of the statistics generated by the system is the inability of the present system or procedure of collecting data to meet the quality standards [Rangarajan 2001].

Information on Births and Child Deaths

(1) *Sample Registration System (SRS)* under the Registrar General of India (ministry of home affairs), regularly measures the births and deaths in a national sample population of nearly six million.

(2) *National Family Health Surveys (NFHS)* were conducted in 1992-93 and 1998-99 in a randomly selected national sample of 486,011 people by the International Institute of Population Sciences, Mumbai [NFHS 2002].

(3) *Civil Registration System (CRS)* under Civil Registration of Births and Deaths Act of 1969, the local governance bodies (gram panchayat and municipality) record births and deaths in their areas.

(4) *Management Information System (MIS)* of the health and family welfare departments of state governments.

The SRS and NFHS provide very useful and quite reliable estimates, especially because of their stratified cluster random sampling. However, they have some limitations. These are:

(1) These cover a very small proportion of the population in each state as their sample. For example, the latest available annual report of the SRS (1998) was based on the information collected from 3,33,000 people in Maharashtra [GoI 2000]. The NFHS II had a still smaller sample of 29,775 from Maharashtra [NFHS 2002]. Hence their estimates, at the most, are reliable for the state level (further disaggregated into urban and rural populations), but not for smaller operational units such as the district or block or primaryhealth centre. Moreover, since the sample size is not large, especially in NFHS, the estimated rates have wide confidence intervals.

(2) The reports of the SRS become available usually after a lag of three to four years, and the NFHS has been conducted once in seven years.

For these reasons the information on child mortality from SRS and NFHS, though useful for five-year planning, is not useful for the performance monitoring of various districts or PHCs on a yearly basis.

The Civil Registration System (CRS), though extensive, records very incomplete information about births and deaths in most states, especially in rural areas. Only in states like Goa and Kerala does the CRS record most of the child deaths. At the national level the CRS registers only 46 per cent deaths, and the completeness of child death registration is still lower [CRS 2002].

However, the health and FW department needs to record every pregnancy and every birth because these constitute their target populations for delivery of services; and every death, because these constitute the events of failure of services. This information is also necessary for monitoring the performance of various levels, from the state down to the village. The flow of information in the management information system (MIS) on a monthly basis, is as follows:

Multipurpose worker (auxiliary nurse midwife) at the sub-centre
↓
Medical officer of primary health centre
↓
District health officer
↓
Directorate of health services, state.

The MIS to the health and FW department is crucial for its effective functioning, like a thermometer to the doctor which provides vital information about the condition of the patient. The patient here is the entire population of the state, and the issue at stake is, literally, life and death of the children. Thus, what seems merely technical information for the internal consumption of the department becomes the critical data on which the actualisation of the 'right to survive' of defenceless infants is decided. The well known principle of the information age warns us that the quality of decisions and governance will be determined by the quality of the data input. 'Garbage in, garbage out!'

In this background, we have prospectively measured child mortality in different areas in Maharashtra, estimated the extent and causes of under-reporting in the state's health and FW department, and then, additionally using the secondary data, estimated the true magnitude of the IMR

and child deaths in the state. In this exercise, we came across some unexpected findings about the national statistical system and the national estimates. We have also assessed the causes of child deaths in Maharashtra and suggested corrective measures for complete recording of child deaths, and discussed a new approach to reduce the IMR in the state.

We want to make it clear that, because the study was not based on random sampling, the findings and inferences are more indicative than definite estimates.

The study was planned to answer the following questions:

(1) What are the child mortality rates in rural, tribal and urban areas in Maharashtra? Is the problem of high IMR (> 60) limited only to the tribal areas?

(2)What is the extent of under-reporting of the IMR in the MIS of the health and FW department of the state?

(3) What corrective measures are necessary for complete reporting of child deaths?

(4) What is the true IMR and the magnitude of child deaths and still births in Maharashtra (with special emphasis on still birth rate and the neonatal mortality rate which are often under-reported).

(5) What are the main causes of child deaths?

II
Methods of Study

Ideally, a stratified random cluster sample should be selected from the total population of the state for measuring child mortality rates. However, since the SRS and NFHS periodically collect data from such samples, not much that is new would be known by repeating a similar survey. Moreover, this study group did not have the resources to conduct a study by this method. On the other hand, the random sample surveys face difficulties in collecting good quality data from the larger number of clusters of population spread over the entire state, more so if the data collectors are outsiders and strangers. Thus, though these surveys are strong on external validity (generalisability), they suffer from the risk of sacrificing internal validity (quality). We decided to collect good quality data from conveniently selected pockets of different types of populations by involving local voluntary organisations who had good base among the populations. Such quality survey, we thought, would give more insight and add more to the existing knowledge. Hence, the study population was selected by stratified cluster sampling but the clusters in each strata were selected by convenient sampling.

We decided to include eight types of strata in the study sample. Seven of these have been listed in the first column in Table 1. The 8th proposed strata was the urban non-slum population living in better housing conditions.

To estimate the IMR over a two-year period we computed the minimum population sample size in each strata to be about 20,000 (× 2 years).

(p of infant death = 0.05, permissible degree of error 0.015, CBR = 21)

To recruit the NGO study partners from various parts of the state, following method was used.

In July and August 1999, over 100 NGOs from various parts of the state were invited for meetings in Nashik, Nagpur and Chikhaldara (Amravati). Those who expressed serious interest in participating in the study were asked to complete the subsequent steps.

A contiguous area of villages or communities (usually its own area of activities) was to be chosen by each NGO as the study area. NGOs were instructed to select average villages, representative of the area, and not deliberately select severely affected or difficult villages. In the urban area, we sought two types. an area of slums or of poor housing conditions, and another area with better housing conditions.

The people in the villages/slums were approached, the purpose and nature of the study were explained and the consent of their leaders was obtained by the involved NGOs. Local supervisors and village (community) workers were selected by each NGO for collecting data.

We selected 19 NGOs who completed the above steps and who provided the required or larger study population in each of the strata 1 to 7. The urban area selected for the study included four slums officially recognised by the municipal corporation, and two areas with poor housing conditions but not declared as slums. All six urban areas were characterised by 'kachcha' or semi-pucca houses or less than two rooms per family, and poor sanitation. We did not get an NGO who had a base in the non-slum urban population living in better housing conditions (strata 8). The selected NGOs together constituted 'The Child Deaths Study and Action Group' (CDSAG), Maharashtra.

Of the 19 NGOs selected at the beginning, one withdrew even before the data collection started, four voluntarily dropped out after one or two rounds of data collection because they could not maintain the rigorous quality requirements of the study, and one NGO had to be asked to withdraw due to poor quality of data collection. Thus, two years of data collection was completed at 13 sites (Figure 2), and only these were included in the analysis.

The definitions of various terms and

Table 1: Study Strata, Sites and Population

Type of Strata	(Stratum No)	District	NGO	Villages/ Slums	Population	Total Strata Population	Percentage of Sample Population
(A) Rural–non tribal							
Eastern region							
Better developed	(1)	Nagpur	NIWCYD	18	21,505		
		Wardha	Chetna Vikas	23	23,253	44,758	19.7
Less developed	(2)	Gadchiroli	SEARCH	47	46,310	46,310	20.4
Western/southern region							
Better developed	(3)	Sangli	RSP	13	26,710	26,710	11.8
Marathwada region			Sahyog				
Less developed	(4)	Latur/Osmanabad	Nirmiti	15	23,880	23,880	10.5
Total rural						141,658	62.4
(B) Tribal							
Eastern region	(5)	Amravati	Khoj	9	3,290		
		Amravati	Melghat Mitra	12	4,533		
		Gadchiroli	AAA	30	10,223		
		Yavatmal	Srujan	15	9,801	27,847	12.3
Konkan/Nashik region	(6)	Nashik	KP	13	16,208		
		Nashik	Vachan	14	16,006		
		Raigad	Jiwhala	22	4,857	37,071	16.3
Total tribal						64,918	28.6
(C) Urban							
Slums and poor housing conditions	(7)	Nagpur	ISSUE	6	20,328	20,328	9.0
Total urban						20,328	9.0
Total				231+6	226,904	226,904	100

Figure 2: CDSAG Study Sites in Maharashtra (1998-2000)

rates used in the study are described in Appendix I.

The 13 selected study sites included 231 villages and six urban slum-like areas from 10 districts with a total population of 2,26,904. The data collection methods used in this study were based on the prototype used by SEARCH in Gadchiroli district for the past 12 years with the proven ability to record 98 per cent of the births and child deaths [Bang et al 1990, 1999]. At 13 study sites, the data on births and child deaths were gathered by a team of 200 community workers under the guidance of 26 supervisors for a period of two years (November 1998 to October 2000). Each family in the area was visited four times during this period. Intensive efforts were made to record all births and child deaths. Each recorded event was verified by the supervisors by visiting the family, a statement about each child death was signed by the parents and the village chief (sarpanch or panchayat member). In the second year of the study (1999-2000,) the cause of death was also determined by the method called 'verbal autopsy'.

All supervisors were trained in SEARCH. The mean post-training score was 86 per cent. The supervisors trained the village (community) workers in their project areas in the presence of the research team.

A house-to-house survey was conducted in November 1999 to collect information on births and deaths by retrospective inquiry for the period November 1998 to October 1999.

A list of pregnant women in the village was made, and all pregnancies were followed up to record the outcome – abortion (<28 weeks), still birth or a live birth.

Incentive money was paid to 'dais' and community workers for the each recorded birth and child death, to encourage complete enumeration.

Supervisors from the NGO visited each house where a birth or death was recorded to verify the event and information. All child deaths were verified and attestation of the parents and village sarpanch was obtained. Only the births and child deaths which physically occurred in the study villages (de facto) were included. The assumptions in using the 'de facto' method were – one, it records more real, verifiable events with less chances of missing; and two, the number of non-resident women who come to the parents' home for delivery is approximately equal to the number of resident women going out for delivery, and hence these balance each other. The births or deaths which occurred in hospitals were included in the village to which the mother belonged.

The research team visited all study sites, checked all records and a sample was checked by home visiting for verification and quality assessment. The errors, if any, were corrected.

A census of the study areas was conducted during the midpoint of the study period (December 1999).

In the second year (November 1999 to October 2000) the information was collected by: (a) ongoing recording of births and deaths by the community workers, and (b) house-to-house surveys in March, July and November 2000 conducted by the community workers under the supervision of the NGO supervisors and the team of researchers. Errors found were rectified and fresh surveys undertaken wherever quality was not satisfactory.

The dais (TBAs), ICDS workers and ANMs in the villages were contacted after each survey to get additional information about any missed births or child deaths.

In the second year of data collection (1999-2000), the cause of death was de-

Table 2: Birth Rate and Still Birth Rate in Study Population (1998-2000)

NGO	District	Type of Area	Population*	Total Births	Per Cent Home Deliveries	Live Births	Birth Rate	Still Births	Still Birth Rate
NIWCYD	Nagpur	Rural	43,010	712	65.0	698	16.2	14	19.7
Chetna vikas	Wardha	Rural	46,506	768	44.1	759	16.3	9	11.7
SEARCH	Gadchiroli	Rural	92,620	2,047	95.5	1,951	21.1	96	46.9
Rugna Seva Prakalpa	Sangli	Rural	53,420	864	31.7	828	15.5	36	41.7
Sahayog nirmiti	Latur/ Osmanabad	Rural	47,760	958	69.6	928	19.4	30	31.3
		Total rural	283,316	5,349	69.1	5,164	18.2	185	34.6
Khoj	Amravati	Tribal	6,580	238	97.5	233	35.4	5	21.0
Melghat mitra	Amravati	Tribal	9,066	401	99.3	386	42.6	15	37.4
amhi amchya arogyasathi	Gadchiroli	Tribal	20,446	649	98.8	629	30.8	20	30.8
Srujan	Yavatmal	Tribal	19,602	423	97.6	416	21.2	7	16.5
Kusumagraj pratisthan	Nashik	Tribal	32,416	571	99.1	552	17.0	19	33.3
Vachan	Nashik	Tribal	32,012	981	90.6	959	30.0	22	22.4
Jiwhala	Raigad	Tribal	9,714	284	94.4	276	28.4	8	28.2
		Total tribal	129,836	3,547	96.1	3,451	26.6	96	27.1
ISSUE	Nagpur	Urban	40,656	792	44.8	762	18.7	30	37.9
		Total urban	40,656	792	44.8	762	18.7	30	37.9
		Total	453,808	9,688	77.0	9,377	20.7	311	32.1

*Note:** - Multiplied by two for the 2-year period of observation.

termined by verbal autopsy. Since the method by verbal autopsy has not been validated for the causes in the neonatal period, we clubbed all neonatal deaths together as one 'cause'. For the rest of the deaths (1-59 months age) a limited number of major causes were considered for assigning the cause of death. We have earlier published the criteria for the cause of death assignment by verbal autopsy [Bang et al 1992]. The various survey forms used are listed in the Appendix II.

Discussions were held at various levels in the H and FW department, including the female MPWs (ANM) of sub-centres, medical officers of PHCs, district health officers, and senior officers in the directorate of health services, Maharashtra to understand the methods of recording births and deaths, difficulties encountered and the possible reasons for under-reporting.

III
Findings and Discussion

The findings and discussion are presented in four sections. In the section A, we present the findings of this 13-site CDSAG study. In section B, we present the estimates of IMR and child mortality in Maharashtra based on different sources of data including the SRS and the NFHS II and finally make a corrected estimate. In section C, the incompleteness of child death reporting in the MIS of the health and FW department of the state, its extent and causes are presented. In section D, we present the causes of child mortality.

(A) Child Mortality at Study Sites

The total population of the 231 villages and six urban slums studied was 2,26,904 (based on the census at the midpoint of the study period, that is, December 1999). The seven strata of the study population, the 13 NGOs and the study sites, their respective districts, number of villages/ slums and the populations studied are presented in Table 1.

Availability of various services in the study population (excluding urban) was as follows:

Roads: 44.7 per cent villages had all-weather tar road.

Transport: Thirty-six per cent villages had a bus stand. Another 19.6 per cent and 31.5 per cent were located within one and five km from the bus stand respectively, and 12.9 per cent villages did not have access to a bus within five km.

School: Ninety-two per cent villages had primary schools and 21.3 per cent had secondary schools.

ICDS: 89.8 per cent villages had anganwadis (ICDS).

Health Services: 29.8 per cent villages had an ANM stationed in the village but in 10.2 per cent villages the ANM was over 10 km away. The mean distance of ANM from villages was 3.9 km;

– 4.4 per cent villages had a PHC stationed in them. Average distance of PHC from the villages was 9.1 km;

– 24 per cent villages had local private doctors. Average distance to a private doctor's clinic was 10.6 km;

– The mean distance of the government hospital was 22 km;

– Pharmacy shops were located on an average 17.1 km from the villages.

The total study population (2,26,904 × 2 years) was adequate for estimating various child mortality rates with precision at the state level, revealed in the not very wide confidence intervals of various estimates (subsequent sections). The size of the study population was comparable to the sample population studied in the SRS (3,33,000 in Maharashtra) and was much larger than one in the NFHS II (29,775 in Maharashtra). However, the sample size at individual study sites was not large and this was reflected sometimes in wide variations in the rates at the individual sites. Hence, too much reliance cannot be placed on the precision of the rates at the individual site. A stratum will be a more reliable unit.

The study population in seven strata was distributed among 13 clusters in 10 districts in various parts of the state. Yet since it was not selected randomly, it was not completely representative of the state population. Though the rural population (62 per cent) was close to the proportion of rural population in the state (57.6 per cent), the tribal population (28.6 per cent) was more than the proportion of tribal population (9.3 per cent) in the state [GoI 2001]. Similarly, the urban population (9 per cent) was lesser than the proportion in the state (42.4 per cent); moreover, our sample included only urban slums and areas with poor housing, and not the urban population living in better conditions. According to one estimate, 65 per cent of the urban population in Maharashtra lived in slums or in poor housing conditions [Gupta and Mitra 2002].

The study sample also had higher proportion from eastern Maharashtra (Vidarbha) because: (a) It harbours a large proportion of tribal population in the state, (b) The only urban slum-like stratum was selected from this region, (c) Four NGOs in other regions either dropped out or could not complete data collection, thereby creating larger representation of the eastern region.

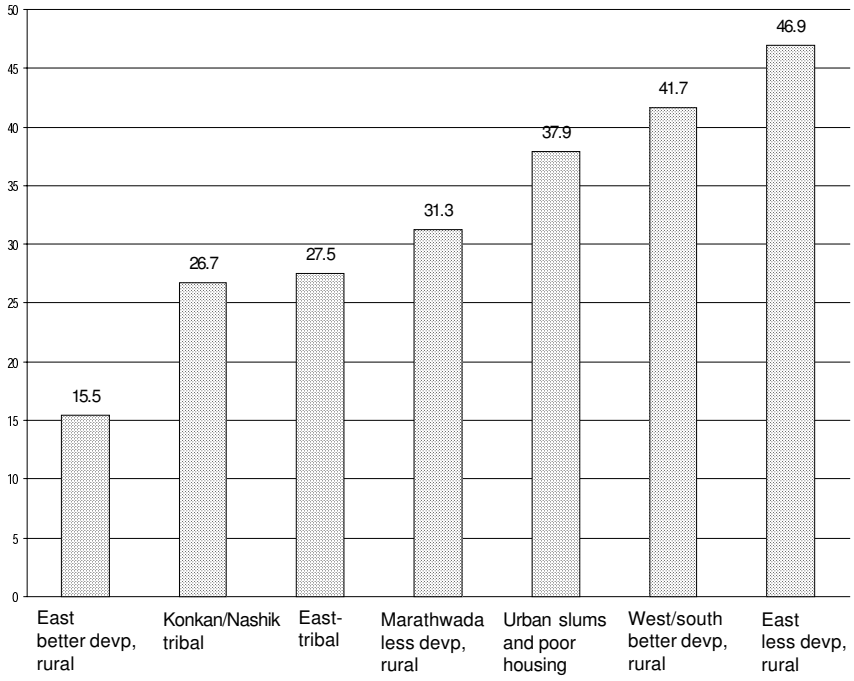
The problem of improportionate

Table 3: Association of Crude Birth Rate with Access to Transport, School and Health Services
(n=225 villages)*

Characteristics	Categories	No of Villages	Population	CBR	p
Distance to the bus stand (km)	Same village	81	208685	18.9	
	0.1 - 5.0	115	175976	20.6	
	> 5.0	29	28490	32.3	<0.01
Type of road to the village	Pucca	96	230142	19.2	
	Kutcha	129	183009	23.4	<0.01
Presence of ICDS worker in the village	Same village	202	389117	20.8	
	Other village	23	24034	20.9	<0.24
Distance from high school (km)	Same village	48	158331	18.2	
	<= 3.0	72	111840	19.8	
	3.1 - 5.0	38	51054	22.1	
	> 5.0	67	91926	24.7	<0.01
Distance from PHC sub centre (km)	Same village	67	182739	19.2	
	0.1 - 5.0	107	157916	20.9	
	> 5.0	51	72496	23.0	<0.01
Distance from primary health centre (km)	<= 5.0	74	166275	18.2	
	5.1 - 10.0	76	150931	21.7	
	> 10.0	75	95945	22.6	<0.01
Distance from private doctor (km)	Same village	54	179164	18.0	
	<= 5.0	70	97420	21.0	
	5.1 - 10.0	45	68594	23.3	
	> 10.0	56	67973	23.9	<0.01
Distance from government hospital (km)	<= 5.0	34	72979	16.7	
	5.4 - 15.0	70	112262	21.4	
	> 15.0	121	227910	21.6	<0.01
Per cent institutional deliveries	<= 30.0	169	256423	22.8	
	30.1 - 60.0	34	85210	17.4	
	> 60.0	22	71518	16.3	<0.01

*Note:** Village characteristics information missing about six villages.

Figure 3: Still Birth Rate (CDSAG)



representation of tribal and urban population or of the eastern region could be overcome by looking at the rates in different strata separately, and by weighting. The only problem which could not be overcome was the lack in the study sample of an urban non-slum population living in better conditions. Quantification of the effect of exclusion of non-slum urban population living in better housing conditions will be possible, as we have attempted in the subsequent section.

The other characteristics of the study villages reveal that access to various social services such as transport, schools, anganwadi or health services was well distributed suggesting that the study population was not especially remote or deprived.

Birth Rate and Still Birth Rate

A total of 9,377 live births and 311 still births were recorded in the study population during the two years (1998-2000). Overall crude birth rate was 20.7 and still birth rate was 32.1. The place of delivery, crude birth rate and still birth rate at different sites are presented in Table 2.

Crude birth rate: The overall crude birth rate of 20.7, (95 per cent CI, 20.2 to 21.1) was very similar to 21.1 (95 per cent CI, 20.6 to 21.6) reported for the state by the SRS (1999) and it varied from 26.6 in tribal areas to 18.2 in rural areas and 18.7 in slum-like areas, as expected. This suggests an effective family planning programme in the state, and that the study population had good access to these services. High CBR in two study clusters in Amravati district could be due to the small population size of these clusters or because of the tribal population and poor level of economic development.

The association of CBR with the access of villages to transport, health services and high school is presented in Table 3. The CBR varied significantly with most of the characteristics as expected, except for the not significant association with the presence of a ICDS worker in village, probably because family planning services reach villages even in her absence.

The CBR in Sangli area was the lowest (15.5). This might be explained by the higher level of development in the district, but could be partly caused by the widespread use of pre-natal sex determination and selective abortion of female foetuses in this part of Maharashtra [GoI 2001] as further discussed in the next section.

Still Birth Rate (SBR): The overall SBR found in this study was 32.1 per 1,000 births (95 CI, 28.6 to 35.6) (Table 2).

High SBR recorded in this study is not likely to be due to false reporting because the quality of data collection was excellent, and every report of still birth was verified by supervisors and certified by the village elders. Sometimes, misclassifying early neonatal deaths as 'still birth' can artificially inflate the SBR and reduce the neonatal mortality rate (NMR). But this is unlikely to have happened in this study because the NMR and the perinatal mortality rate (PMR, that is, the sum of SBR and early NMR during 0-7 days) were also high (Table 4).

High SBR could not be explained as random fluctuation, because the confidence interval was not very wide. It was also not because of the selection bias in the study population because the SBR and the PMR were high in all three types of study populations (Tables 2 and 4) and in the various regions of the state (Figure 3). Hence, the high SBR was a general feature.

It is very easy to under-record still births because families forget to report a birth which did not result in a living child. The interviewer, if he visits only once or periodically, does not see anything (living child) to counter-check. Hence, both the informer and the interviewer may miss recording the event of still birth.

One method to completely record the still births is to register pregnancies early and follow each pregnancy for its outcome. This method was used in the study. As the communities were actively involved in the study, the data collectors were from the same communities, and information on births (live or still) was also collected from traditional birth attendants (dais), this may explain the higher SBR due to more complete recording of still births in this study. The highest SBR was recorded in rural Gadchiroli, where SEARCH has a high-quality vital statistics surveillence system which probably yielded more complete reporting.

The SBR was higher in the non-tribal rural areas (34.6) and urban slum-like areas (37.9) than in the tribal areas (27.1). A similar unexpected feature was observed in the perinatal mortality rate. In spite of our best efforts, some degree of recall loss in reporting still births might have occurred in the tribal areas. The alternative explanation, that maternal health is better in the tribal areas leading to lower SBR, does not seem plausible.

Child Mortality Rates

A total of 777 child deaths were recorded during the two years. Age-specific child mortality rates at various study sites and in three types of areas (rural, tribal and urban) are presented in Table 4. The significant findings in the table are:

– Wide variations are obvious within

each stratum. This may be partly due to small sample size of the individual sites;
– The IMR was >60 in 10 out of 13 study areas. The phenomenon was not restricted to tribal areas but was prevalent in non-tribal rural areas and urban slums as well. The mean IMR in these 13 areas was 68.7.
– The mean NMR was 51.2. Thus 75 per cent of infant mortality, and 61.7 per cent of the <5 years mortality, occurred in the neonatal period (0-28 days).
– Mortality rates in the 0-1 year and 1-4 year age groups were highest in the tribal population. The IMR in two tribal areas was as high as 90. Though the NMR in tribal areas was almost at the same level as in the non-tribal areas, the PNMR and 1-4 MR were twice as high.

Neonatal mortality rate: The mean neonatal mortality rate (NMR) was 51.2. It was greater than 40 in 10 out of 13 study areas 5/7 tribal areas, 4/5 rural areas and 1/1 urban slum-like area (Table 4).

The observed high NMR cannot be explained by still births misclassified as neonatal deaths because the SBR and perinatal mortality rate were also high. Moreover, the high NMR (>40) was not localised, but was observed in 10/13 study areas.

High NMR in urban slums, in spite of the availability of private doctors next to the slums or of government hospitals within 5 km, as well as transport, suggest that for neonates, care was not accessible. The neonates suffer from a social/cultural distance from health care, even when the care is available nearby.

Infant mortality rate: The mean infant mortality rate (IMR) was 68.7. The national goal of reducing IMR to < 60 by 2000 provides a standard against which the IMR found in this study could be compared. It was > 60 in 10 out of 13 study areas.

The improportionate representation of tribal or urban population in our study sample cannot explain the observed high IMR because it was high separately in all three types of populations (Table 4).

The IMR, as we shall present in the later section, showed significant association with various indicators of development such as distance of the village from the bus stand or backwardness of the eastern region of the state or the percentage of population living below poverty line.

(B) Estimating Corrected Child Mortality Rate

> One accurate measurement is infinitely superior to a thousand intelligent opinions.
> – Murphy's Law

Due to the limitation of not being a random sample survey, this study is not the ideal basis to make state-level estimates directly. However, the evidence generated by the study at 13 micro-sites can be used in two ways. One, new insights about the SRS and NFHS are obtained by comparing with the findings of this study. Two, corrected IMR and child deaths can be estimated by applying these insights to the SRS and NFHS.

Various child mortality rates in Maharashtra observed in this study are

Table 4: Age-Specific Child Mortality Rates in Study Population (1998-2000)

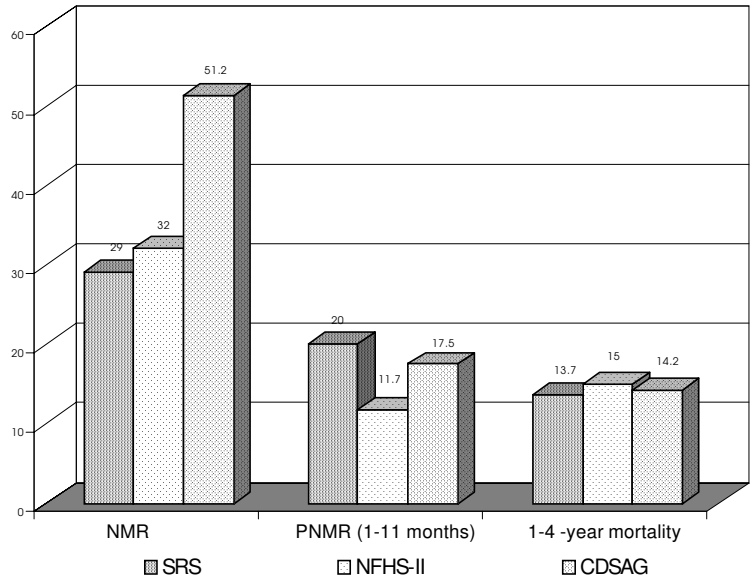
Name of NGO (Study sites)	District	Neonatal deaths	Neonatal Mortality Rate	Perinatal Mortality Rate	Infant Deaths	1-11 Month Deaths	Post-Neonatal Mortality Rate	Infant Mortality Rate	1 – 4 Year Deaths	1-4 year Mortality Rate	< 5 Years Child Deaths	< 5 Years Child Mortality Rate
NIWCYD	Nagpur	34	48.7	60.4	46	12	17.2	65.9	3	4.3	49	70.2
Chetna Vikas	Wardha	45	59.3	59.9	54	9	11.9	71.1	6	7.9	60	79.1
SEARCH	Gadchiroli	128	65.6	90.9	156	28	14.4	80.0	23	11.8	179	91.7
R S P	Sangli	28	33.8	63.7	33	5	6.0	39.9	5	6.0	38	45.9
Sahayog Nirmiti	Latur/ Osmanabad	40	43.1	65.8	52	12	12.9	56.0	15	16.2	67	72.2
	Total rural	275	53.3	70.7	341	66	12.8	66.0	52	10.1	393	76.1
Khoj	Amravati	11	47.2	42.0	18	7	30.0	77.3	4	17.2	22	94.4
Melghat Mitra	Amravati	20	51.8	67.3	35	15	38.9	90.7	14	36.3	49	126.9
A A A	Gadchiroli	44	70.0	81.7	57	13	20.7	90.6	9	14.3	66	104.9
Srujan	Yavatmal	21	50.5	44.9	28	7	16.8	67.3	10	24.0	38	91.3
K P	Nashik	20	36.2	56.0	39	19	34.4	70.7	12	21.7	51	92.4
Vachan	Nashik	38	39.6	45.9	52	14	14.6	54.2	10	10.4	62	64.7
Jiwhala	Raigad	15	54.3	66.9	22	7	25.4	79.7	8	29.0	30	108.7
	Total tribal	169	49.0	56.1	251	82	23.8	72.7	67	19.4	318	92.1
Issue	Nagpur	36	47.2	73.2	52	16	21.0	68.2	14	18.4	66	86.6
	Total urban	36	47.2	73.2	52	16	21.0	68.2	14	18.4	66	86.6
	Total	480	51.2	67.7	644	164	17.5	68.7	133	14.2	777	82.9

Table 5: Comparison of Child Mortality Rates in Maharashtra Reported in Different Surveys

Type of Area	NMR			IMR			NMR Per Cent of IMR			PNMR (1 month-1 year)			1-4 Year Mortality Rate			1-4 Year Mortality Compared to IMR			<5 Year Mortality Rate		
	CDSAG	NFHS	SRS	CDSAG	NFHS	SRS	CDSAG	NFHS	SRS	CDSAG	NFHS	SRS	CDSAG	NFHS	SRS	CDSAG	NFHS	SRS	CDSAG	NFHS	SRS
Total	51.2	32.0	29.0	68.7	43.7	49.0	74.5	73.2	60.3	17.5	11.7	20.0	14.2	15.0	13.7	0.21	0.34	0.28	82.9	58.1	62.7
Rural	51.5	36.7	33.0	68.7	50.6	58.0	75.0	72.5	57.6	17.2	13.9	25.0	13.8	18.0	15.9	0.21	0.36	0.27	82.5	67.8	73.9
Urban	47.2	24.7	22.0	68.2	33.0	32.0	69.2	74.8	69.0	21.0	8.2	10.0	18.4	10.2	8.9	0.27	0.31	0.28	86.6	42.8	40.9
Rural non-tribal	53.3	-	-	66.0	-	-	80.8	-	-	12.7	-	-	10.1	-	-	0.15	-	-	76.1	-	-
Rural tribal	49.0	-	-	72.7	-	-	67.4	-	-	23.7	-	-	19.4	-	-	0.27	-	-	92.1	-	-

Notes: CDSAG: Child Death Study and Action Group, Maharashtra: 1998-2000 (this study);
NFHS-II: National Family Health Survey (1998-99);
SRS: Sample Registration System, Registrar General of India (1998);
Rural includes non-tribal as well as tribal areas.

Figure 4: Child Mortality Rates in Different Surveys



compared with the reported rates in the SRS and NFHS II in Table 5 and Figure 4. The salient findings are:

(1) The overall (total) mortality rate in 1-4 years children was similar in three surveys (14.2, 15.0 and 13.7). Hence this rate can be considered valid and robust.

(2) The overall post-neonatal mortality rate in CDSAG and SRS was also not very different (17.5 and 20.0). The observed difference could be explained by some degree of misclassification between neonatal and post-neonatal deaths. The PNMR in Maharashtra, as reported in the SRS, shows a sudden unexplained increase in 1998 compared with the earlier years [GoI 2000]. Hence, instead, if we take a mean PNMR of three years (1996-98) it was 16.7, similar to the one found in this study.

(3) The overall NMR (and SBR) in the CDSAG study was nearly 20 points greater than that reported in the SRS and NFHS II. This was the most important difference. This phenomenon was observed in rural as well as urban strata. (The 'rural' strata in Table 5 includes tribal and non-tribal rural areas because the SRS and NFHS do not provide separate rates.)

(4) The IMR was nearly 20 points higher in the CDSAG. This difference can be explained by two factors. The main difference was caused by the higher NMR recorded in CDSAG. This presumably was due to better quality of data collection in CDSAG. However, the selection bias in the study population in CDSAG also might have contributed to the estimated higher IMR.

(5) The IMR in the rural population in the CDSAG was nearly 10 points higher than that in the SRS-rural. This appears to be a true difference, especially because the CBR and 1-4 years MR in the rural population were similar in the two surveys.

(6) The sample size of NFHS-II was small (29,775 in Maharashtra), making its estimates at the state level imprecise with wider confidence interval. For example, the IMR and its 95 per cent confidence interval based on the NFHS II data was 43.7(34.6 to 52.9). Moreover, the NFHS-II used retrospective inquiry which may suffer from the possibility of recall loss, especially for still births and neonatal deaths. The use of outside investigators, most often an urban educated person, temporarily visiting the rural and tribal areas scattered all over the state to collect information, without local community involvement, could result in missing of some events.

(7) All rates in the urban population in the CDSAG were higher than in the SRS or NFHS, representing the effect of including in the study sample only the population living in slums and poor housing conditions.

Neonatal Mortality Rate and the IMR: The NMR observed in the rural

Table 6: Weighted Estimation of CBR, SBR and IMR in Maharashtra (CDSAG Study)

Type of Population	Population in 2001 (1)	Per Cent	CBR (2)	Annual Live Births (1x2)/1000 (3)	Annual Total Births# (4)	SBR (5)	Annual Still Births (4x5)/1000 (6)	IMR (7)	Annual Infant Deaths (3x7)/1000
Tribal	8,968,933@	9.3	26.6*	238,574	246,447	27.1 *	6,679	72.7 *	17,344
Rural (non-tribal)	46,763,580(b)	48.3	23.6ǂ	1,103,621	1,140,040	34.6 *	39,445	66.0 *	72,839
Urban									
Slums and poor housing conditions (50 per cent population)¤	20,509,867$	21.2	28.3 ¤	580,429	599,583	37.9 *	22,724	68.2 *	39,585
Better housing conditions (50 per cent population)¤	20,509,867$	21.2	13.3 ¤	272,781	281,783	9.5 **	2,677	17.0¤	4,637
Total	96,752,247(c)	100	22.7†	2,195,405++	2,267,853++	31.5†	71,525	61.2†	134,405

Notes: @ : Scheduled tribes population in Maharashtra (1991 Census) 9.27.
(b) : Based on Census 2001, total rural population minus tribal population.
(c) : Census 2001
¤ : Based on census 1981 to 1991 and NSSO. (see text)
$: 50 per cent of the urban population in Census 2001.
* : CDSAG (1998-2000). The SRS does not publish CBR in tribal population.
** : 25 per cent of the SBR in non-slum urban population. (see text)
ǂ : Based on SRS rural in 1998.
† : Weighted estimation.
# : Proportion of total births to live births is 1.033: 1, CDSAG 1998-2000.
++ : Sum total of the column.

(tribal + non tribal) area in our study was nearly 20 points greater than the comparable NMR reported in the SRS. (Table 5). Similarly, its share in the IMR was 75 per cent as against 60.3 per cent reported in the SRS [GoI 2000]. This needs further scrutiny.

The difference cannot be explained by different study sample or different study periods (1998 vs 1998-2000), which may cause some difference in the absolute levels of IMR and NMR, but cannot explain the gross difference in the proportions (60.3 per cent vs 75 per cent). On the contrary, as the reported IMR in the SRS for Maharashtra is lower (49) than found in the CDSAG study (68.7), one would expect a higher per cent share of NMR in the SRS.

Our finding that the NMR contributed nearly 75 per cent of the IMR in Maharashtra is well supported. The NFHS II reported that the NMR contributed 73 per cent of the IMR in Maharashtra (Table 5). Similarly, the NMR contributed 70-76 per cent of the IMR in the states with moderately reduced IMR in Andhra Pradesh, Karnataka and Tamil Nadu during 1995-97 (SRS) [James et al 2000]. Tamil Nadu, with a higher proportion (76.3 per cent) of hospital deliveries [IIPS 2000] is a state where the likelihood of missing neonatal deaths is less. SRS reported the NMR to be 74 per cent of the IMR in Tamil Nadu in 1996. Goa has the best CRS with 92 per cent complete reporting of infant deaths. During the four-year period (1995-98), the mean NMR as percentage of IMR was 81.5 per cent in Goa and 78.8 per cent in Kerala [CRS 2002]. The vital statistics collected in 47 villages in the control area of SEARCH also reported NMR of 58.6, constituting 75 per cent of the IMR during 1995-98 [Bang et al 1999].

Thus the 75 per cent proportion of NMR in IMR observed in the CDSAG study is well supported by other reports. A smaller proportion reported currently in other surveys is an evidence of under-reporting of neonatal deaths.

The IMR in India declined by 48 per cent, from 139 in 1972 to 72 in 1996 (SRS). However, during the same period, the post-neonatal component declined more (63.3 per cent) than the NMR, which declined only by 34 per cent, resulting in an increase in the share of NMR in the IMR. Similarly, as the IMR in Maharashtra declined the share of NMR increased from 58 per cent in 1971-73 to 70 per cent in 1995-97 [James et al 2000]. The trend suggested that with the progressive decline in IMR, the share of the NMR should increase. In this background, it is intriguing that the SRS reported the NMR in Maharashtra in 1998 to be 29.0, that is, 60.3 per cent of the reported IMR of 49.0. All other evidence cited earlier, including the SRS reports of 1995-97, suggests that the NMR should constitute at least 70 per cent to 75 per cent of the IMR in Maharashtra during 1998-2000. This further suggests that the current NMR is an underestimate.

The probable explanation is that the enumerators in the SRS might have missed a proportion of neonatal deaths. Neonatal deaths in home deliveries can very easily remain unreported as do still births. Since the baby is not named till then, an interviewer, especially if he is a male or is not from the same community, can easily miss eliciting such information from the family. For these reasons, the SRS surveyors are likely to miss some still births and neonatal deaths. The evidence in this study suggests that both of these might be happening.

Both the SRS and the NFHS may face the problem of maintaining quality of data, as the population clusters selected are scattered over the entire state. Evaluation of the completeness of recording of births and child deaths in the SRS has not been conducted in past 20 years. Evaluation of the recording of the events most likely to be missed, that is, still births and neonatal deaths, has never been conducted. Hence, the extent of under-estimation, if any, cannot be known. Comparison with the CDSAG findings provides a preliminary quantification of the under-reporting. We have already discussed the probable explanations of more complete recording of the still births and neonatal deaths in the CDSAG study.

The problem of gross under-recording of neonatal deaths and still births is commonly encountered in developing countries because of the invisibility of these events to the outside world. The World Health Organisation and many researchers have expressed concern about this problem [WHO 1996, Save the Children 2001].

It is important to recognise this fact because recently the government of India has become alarmed by the stagnation of IMR in India at the 70-75 level for last five years (1993-98). The main reason is that neonatal mortality is relatively unaffected. If this problem has to receive due attention, correct estimation of neonatal mortality is a necessary prerequisite.

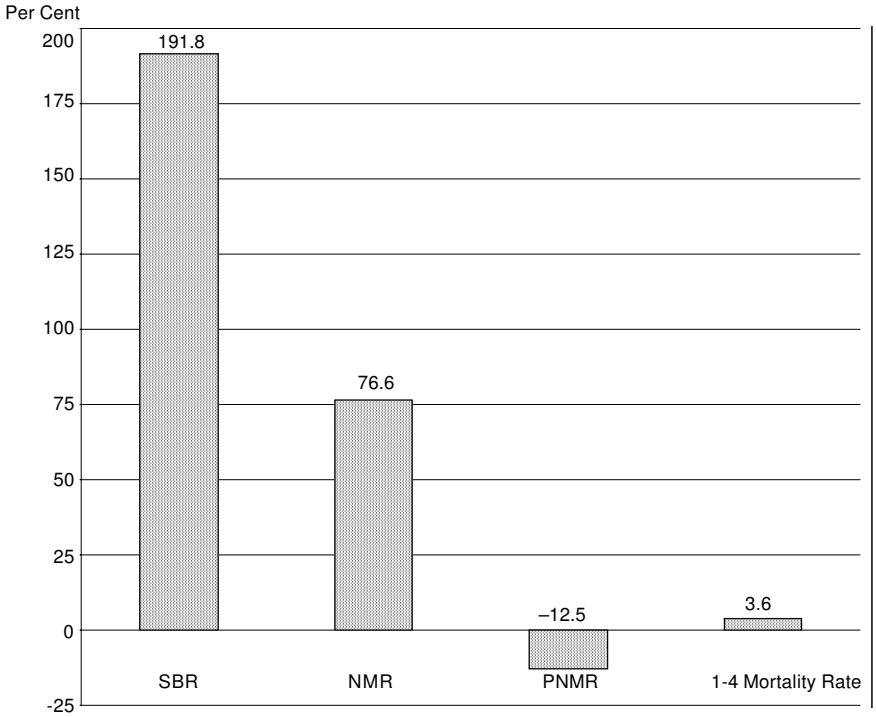
We recorded the lowest NMR in one of the most developed rural areas in

Table 7 : Estimated Annual Still Births and Child Deaths (Live Births = 2,176,926 *)

Source of information	IMR	1-4 years CMR	< 5 years CMR/1000LB	Estimated Total Child Deaths (95 Per Cent CI)@		Estimated Total Still Births (95 Per Cent CI)	
	(1)	(2)	(1+2)				
(1) NFHS II	43.7	15.0	58.1	126,479	(105,363 - 147,378)	-	
(2) SRS (1998)	49.0	13.7	62.7	136,493	(125,826 - 147,160)	24,210	(19,148 - 29,272) $
(3) Corrected SRS							
i) Based on 3-year mean PNMR in SRS and PNMR as 25 per cent of IMR	66.8	13.7	80.5	175,243	(162,834 - 187,651)	-	
(ii) Based on the 1-4 years CMR in SRS 1998, and the ratio to IMR in CDSAG	66.2	14.2	80.4	175,025	(164,140 - 185,909)	-	
(4) CDSAG (1998-2000)	68.7	14.2	82.9	180,467	(168,276 - 192,440)	72,185	(64,315 - 80,056)#
(5) CDSAG weighted estimate (1998-2000)	61.2	14.2	75.4	165,534@@	(154,776 - 176,291)	71,525	(63,500 - 79,375) #

Note: *: Based on population 96,752,247 (Census 2001) and CBR = 22.5 (SRS 1998).
@: Estimate based on live births in Maharashtra and < 5 years CMR from respective source.
@@: Estimate based on the < 5 years CMR and the live births in Maharashtra both estimated by the weighted CDSAG (Table 9).
$: Estimated by using ratio of total births to live births in SRS as 1.011: 1.
: Estimated by using ratio of total births to live births in CDSAG as 1.033: 1.

Figure 5: Percentage Difference in Age-Specific Mortality Rates in CDSAG and SRS*



Note: *Using SRS (1998) as the basis.

Maharashtra (Sangli), where it was 33, similar to the NMR reported by the SRS or NFHS II for the whole of Maharashtra (29 and 32 respectively). The NMR in all other 12 study areas was higher. Even in the urban slum-like area, with a large proportion (55 per cent) of hospital deliveries, it was 47.2. Thus the problem of high NMR is certainly widespread and of greater magnitude than estimated by the SRS or NFHS.

The difference in NMR of nearly 20 points in our study and in the SRS/NFHS II almost completely explains the observed difference in IMR (Table 5). Moreover, a possibility of misclassifying neonatal deaths as post-neonatal deaths in the SRS was evidenced by the lower NMR (29) and higher PNMR (20), and also by the much lower (60 per cent) proportion of IMR contributed by the NMR, in the SRS (1998).

Still birth rate: The still birth rate reported in this study, 32.1 (Table 2) was nearly 20 points higher than the reported SBR of 11 by the SRS for the state [GoI 2000], or nearly twice the SBR of 16 estimated from the NFHS II [NFHS 2002]. This is a major departure.

We have already discussed the quality of data and other explanations about SBR recorded in this study. The SBR of 37.9 recorded in this study in urban slum-like areas where 55.2 per cent deliveries occurred in hospitals and the SBR of 41.7 in Sangli where 68.3 per cent deliveries occurred in hospital, are the evidence that relatively high SBR can exist in spite of access to hospital services. This further suggests that the SBR of 11 as reported in the SRS for the whole state does not seem plausible.

Four other pieces of good quality data on SBR support our findings:

(i) The National Neonatology Forum of India has collected data from 16 urban centres for 1995. It reported that in 38,592 hospital deliveries, the SBR was 39.1 when the NMR was 37.7 [AIIMS 1996].

(ii) The vital statistics collection system of SEARCH in 47 control villages in Gadchiroli, in a published field trial, recorded an SBR of 40.8 during the three-year period 1995-98 [Bang et al 1999].

(iii) Matlab area in Bangladesh has a well known vital statistics surveillance system which has been the basis of various research studies. The SBR in the Matlab area was reported in 1990 to be 38.3 [Fauveau 1990].

(iv) Interestingly, the SBR in the US in 1940 was reported to be 29.5 when the NMR was 29.0. At that level of NMR, the SBR was almost equal. Even in 13 states in the US which followed the same definition of still birth (>28 weeks of gestation) as in this study, the SBR was 28.5 and the NMR was 26.9 [American Journal of Public Health 1994]. As the NMR reported for Maharashtra by the SRS is very similar to that recorded in the US at that time, one would expect an SBR of similar order.

These four reports, along with the findings in this study, suggest an underestimation of SBR in the SRS.

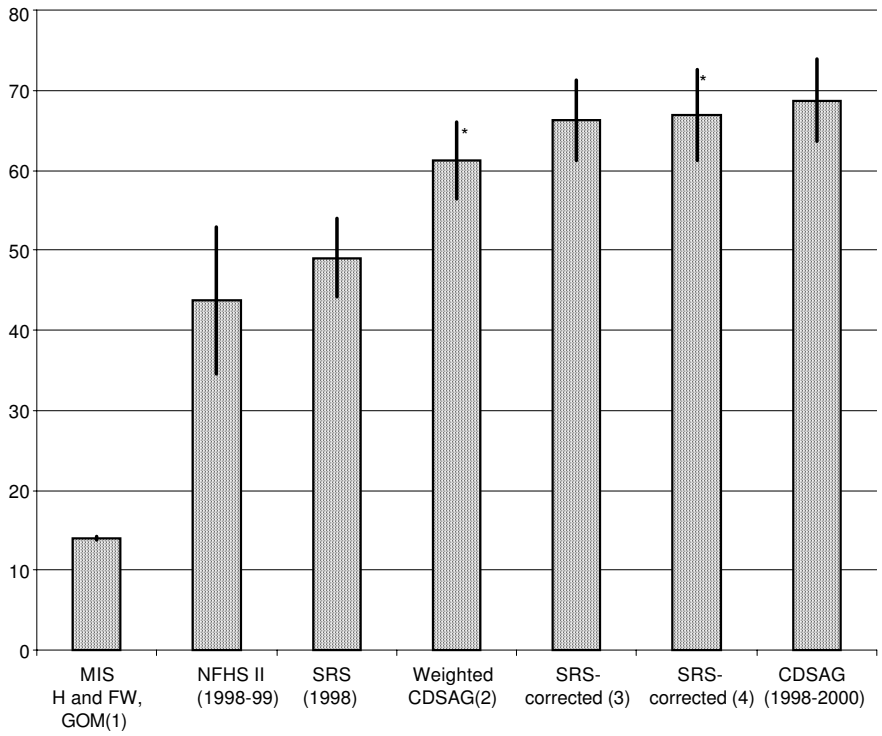
Gradient of completeness: The completeness of reporting in the SRS, in comparison with our study, improved as the age at death increased (Figure 5). The difference was maximum (191.8 per cent) for still births, and minimum (3.6 per cent) in the 1-4 years age group. This is understandable in view of the difficulties in getting information about still births and neonatal deaths while the deaths of older children (1-4 years) are difficult to forget or hide.

Table 8: Incompleteness of Reporting of Infant Deaths in MIS

Districts	Expected Number of Infant Deaths (Based on SRS and SCD Estimates)	Reported Deaths in the MIS of Health Department	Per Cent Completeness of Reporting in the MIS of the Health Department
Raigad	2366	906	38
Ratnagiri	1802	175	10
Thane	4699	140	3
Ahmednagar	4326	1602	37
Dhule	2047	746	36
Nandurbar	1609	512	32
Jalgaon	3919	1891	48
Nashik	4562	213	5
Pune	4410	1092	25
Solapur	3368	237	7
Satara	3011	1212	40
Kolhapur	3118	757	24
Sangli	2180	652	30
Sindhudurg	741	302	41
Aurangabad	2303	483	21
Jalna	2098	508	24
Parbhani	2947	491	17
Beed	2627	789	30
Nanded	3404	304	9
Latur	2477	589	24
Osmanabad	1677	732	44
Akola	1917	531	28
Washim	1253	407	32
Amrawati	2266	1148	51
Buldhana	2347	1007	43
Yavatmal	2493	1644	66
Bhandara	2635	1468	56
Chandrapur	2519	774	31
Gadchiroli	1325	1035	78
Nagpur	1980	1196	60
Wardha	1179	452	38
Total	79605	23995	30

Source: The annual report (1999-2000) of the additional director, Division of Vital Statistics,Health and Family Welfare, Goverenment of Maharashtra, Pune.

Figure 6: Estimated Infant Mortality Rate



Notes: * 95 per cent Confidence Interval.
(1) Management Information System, Department of Health and FW, Government of Maharashtra (1999), see Table 7.
(2) Weighted by the proportion of the tribal, rural and urban population in census 2001.
(3) Estimate based on the 1-4 year CMR in SRS 1998, and its ratio to IMR as found in CDSAG.
(4) Estimate based on 3-year (1996-1998) average PNMR in SRS and the proportion of PNMR to IMR at 25 per cent.

By making use of the insights so obtained, we have attempted to estimate the corrected IMR by three methods, using the data from CDSAG and SRS.

Weighted Estimation Based on CDSAG

Since the study population in CDSAG was not completely representative of Maharashtra, we have made a weighted estimation of the IMR by using: (a) the proportion of tribal, rural and urban populations in Maharashtra as reported in the census 2001, (b) the strata-specific CBR as reported in the SRS, and (c) applying to these the strata-specific IMR found in the CDSAG (Table 5).

The first difficulty encountered was the lack of exact estimates of urban population living in slums and in poor housing and environmental conditions. The proportion of slum population in urban Maharashtra has been reported to be 32 per cent [GoI 2001]. However, a sizeable proportion of the urban population lives in poor housing conditions, but the areas are not officially declared by the authorities as slums. Another estimate of the proportion of urban population living in poor housing conditions (homeless or no exclusive room or only one room for the family) in Maharashtra is nearly 65 per cent [Gupta and Mitra 2002]. We have arbitrarily assumed the proportion of urban population living in slums and poor housing conditions (SPHC) to be 50 per cent, nearly the midpoint of these two estimates of 32 per cent and 65 per cent.

The crude birth rates for the two types of urban populations are not reported separately by the SRS or CRS. Hence we have used the ratio of CBR in urban population (total) to the CBR in urban poor, that is, 1:1.36 [Gupta and Mitra 2002] and using that, fixed the CBR for the urban SPHC population at 28.3 and for those living in better housing conditions at 13.3. With 50 per cent population of each type, as assumed by us, the overall CBR for the urban population remains 20.8, same as that reported by the SRS for urban areas in Maharashtra [GoI 2000]. Hence, our assumptions are not wide of the mark.

The last gap in the available information from the SRS was the lack of estimated IMR for the urban population of these two types. We have used the CDSAG estimate of the IMR in the urban population living in SPHC, that is, 68.2 for the first type population. In the absence of any reliable estimate of the IMR in the urban population living in better housing conditions, we have used the reported ratio, that the IMR for urban poor was twice that of the total urban population [Gupta and Mitra 2002]. With 50 per cent population of each type, the IMR for the population living in better conditions is thus indirectly estimated to be 25 per cent of the IMR for the SPHC population, that is, 17.0, which is close to the IMR of 13, reported in the NFHS II for the economically better population in Mumbai [NFHS 2002].

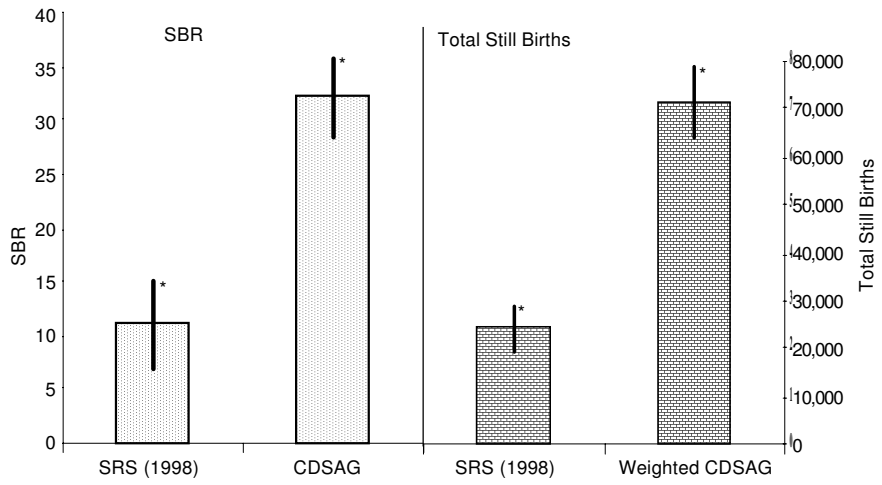
Using these assumptions, the weighted IMR for Maharashtra is estimated to be 61.2 (95 per cent CI, 56.3 to 66.1) (Table 6).

Table 9 : Cause of Death Children and Cause-Specific Mortality Rates in the Second Year of the Study (1999-2000)

Cause	No	Deaths		Cause-specific Mortality Rate/1000 Live Births†
		Per Cent of all Deaths	Per Cent of Deaths in 1- 59 Months Age	
Neonatal deaths*	226	58.7	-	47.9
Pneumonia**	51	13.2 $	32.1	10.8
Diarrhoea**	39	10.1 $	24.5	8.3
Malnutrition** (Obvious to mother)	40	10.4 $	25.2	8.5
Immunisable diseases** (Measles)	7	1.8 $	4.4	1.5
Other /not known**	48	12.5 $	30.2	10.2

Notes: Popluation = 226, 904 Live births= 4714 Child deaths = 385.
* All neonatal deaths combined as a single category.
** In 1- 59 months age group.
$ Since these causes were not assigned in the neonatal deaths, their proportion appers low, in this column.
† Since more than one cause was assigned to many deaths, the total is more than 100 per cent or totall CMR.

Figure 7: Still Birth Rate and Estimated Total Still Births



Note: * 95 per cent Confidence Interval.

By Correcting IMR in the SRS

Different estimates of the IMR are reported by three studies; NFHS II: 43.7, SRS: 49.0 and CDSAG: 68.7 (Table 5). We have discussed earlier the limitations of each survey and the possible explanations of the different estimates.

In spite of its limitations, the SRS remains the best available source of data for its good sampling technique, relatively larger sample size and the dual method of recording of vital events. Yet the data collection probably suffers from some degree of incompleteness in recording still births and neonatal deaths, as discussed earlier. Hence, we have made the estimates of IMR, child deaths and still births in Maharashtra by using the SRS data as the basis and corrected it for its presumed incompleteness. This was attempted in two different ways, in each of which we have used the more completely recorded components of child mortality rates in the SRS to estimate the corrected IMR.

Based on the PNMR in SRS: The post-neonatal mortality rate was quite similar in the SRS and CDSAG (Table 5), suggesting that it was recorded more completely. However, it contributed 40.8 per cent of the IMR in the SRS, higher than in CDSAG or NFHS, probably because the NMR component was under-recorded in the SRS.

The PNMR reported by the SRS in 1998 shows a sudden increase from earlier years. This could be due to a new sample selected periodically in the SRS, or due to misclassifying neonatal deaths as post-neonatal. Hence, we used the mean PNMR of three years (1996, 1997, 1998) reported by the SRS [GoI 2002]. It was 16.7.

As discussed earlier, the proportion of NMR in IMR in the more complete reporting systems [Bang et al 1999, James et al 2000, CRS 2002, IIPS 2000] was 70-80 per cent. Moreover, the NMR reported in the NFHS II in Maharashtra was 73 per cent of the IMR, and in the CDSAG it was 75 per cent.

By using the three-year average PNMR of 16.7 in the SRS and the proportion of the NMR at 75 per cent, the estimated corrected IMR for Maharashtra is 66.8 (95 per cent CI,61.1 to 72.5).

Based on ratio of IMR to 1-4 years CMR in SRS, 1998: Another corrected estimate of the IMR can be made based on the 1-4-year mortality rate in the SRS. Since this rate is practically same in all three surveys, (SRS 13.7, NFHS II: 15.0, CDSAG: 14.2) (Figure 4), it is even more robust than the PNMR. The ratio of 1-4-year mortality rate to IMR in the CDSAG was 0.207 (Table 5). Using this ratio, and the 1-4 mortality rate (13.7) as reported in the SRS, the corrected IMR is estimated to be $\frac{13.7 \times 100}{20.7}$ = 66.2 (95 per cent CI,61.2 to 71.2), quite close to the earlier estimate of the corrected IMR of 66.8. It also fits in with our earlier observation that the NMR in the SRS was under-reported by nearly 20 points, hence the corrected NMR and IMR should be nearly 20 points greater than the current estimates of the SRS.

Various estimates of the IMR are compared in Figure 6. Their 95 per cent confidence intervals are also shown at the top of each bar. Of these, we consider 66.2 as the most robust estimate because it is based on the SRS sample, 1-4-year mortality rate which was almost the same in all three surveys, and the ratio of 1-4-year mortality rate with IMR, as found in the CDSAG study presumably with more complete recording.

Using these different estimates of the corrected IMR, the estimated number of child deaths in Maharashtra are shown in Table 7. Of these, we consider 175,025 as the most robust estimate for the same reasons.

Estimated Annual Still Births

Total births in Maharashtra = Live births 2,176,926, (SRS 1998) + still births. Using the different SBR reported by different sources plus live births based on the SRS 1998, the estimated number of annual still births in Maharashtra is:

(1) Based on the SRS (SBR: 11) = 24,210 (CI, 19,148 to 29,272);

(2) Based on the CDSAG (SBR: 32.1) = 72,185 (CI, 64,315 to 80,056);

(3) Based on weighted CDSAG (SBR 31.5=71,525 (CI, 63,500 to 79,375).

Of these the last is the most reliable estimate.

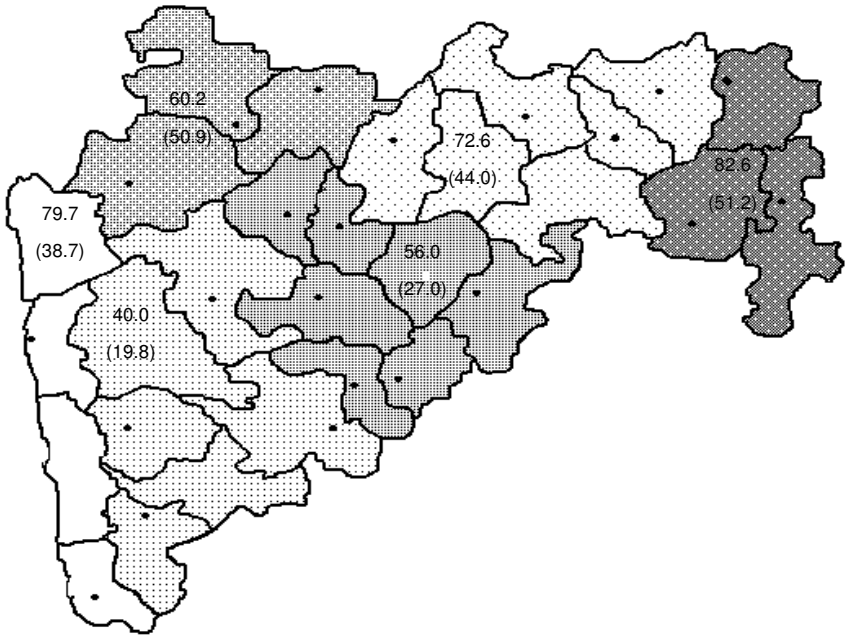
Thus, we have different estimates of still births, IMR and total child deaths in Maharashtra (Figures 6, 7, Table 7). We

Table 10: Infant mortality Rate in Eastern Region (Vidarbha) Vs Rest of Maharashtra

Type		Eastern	Other regions	Per Cent Excess Mortality in Eastern Region	P
Rural					
	Developed	68.6	39.9	71.9	<0.007
	Less developed	80.0	56.0	42.9	<0.026
Tribal		82.9	63.2	31.2	<0.031
Urban		68.2	NA	-	-
Total		76.4	55.9	36.7	<0.0002

Note: NA = Not Available.

IMR in Different Zones of Rural Maharashtra (CDSAG 1998-2000)



Note: (Per cent rural families below poverty line: 1997-98, government of Maharashtra

have already discussed the possible explanations of the differences.

Thus *we finally estimate* that during 1998-2000,

(1) The infant mortality rate in Maharashtra was between 61.2 and 68.7, most probably at 66.2 (95 per cent CI, 61.2 to 71.2).

(2) Annual number of <5 years child deaths in Maharashtra was between 165,934 and 180,467, most probably 175,025 (95 per cent CI, 164,140 to 185,909).

(3) Total annual number of still births were 71,525 (95 per cent CI, 63,500 to 79,375).

(C) Under-reporting of Child Deaths

(1) *Why should each birth and child death be recorded in the management information system (MIS) of the health department?*

While the SRS, NFHS or CDSAG estimates are useful for health policy and planning, these are only periodic estimates recorded in a small (< 1 per cent) sample population. The health and FW department of the state needs to identify and record *each* pregnant woman, delivery, live birth and sick child at risk of dying, thereby identifying the target group for health care. The department also needs to record each still birth and each child death as a measure of the failure of its activities.

The department records and reports these events in the management information system (MIS). These data are expected to become the instrument of ongoing performance monitoring and evaluation of various levels of health services – subcentre, primary health centre, district, division and the state. The administrator cannot effectively manage health services without such performance data. The SRS, NFHS, CDSAG are not substitutes to the performance monitoring of the various units of health services by way of MIS.

Since these data are used by the department for monitoring and controlling statewide operations, and are often conveniently cited to non-technical persons like bureaucrats, politicians or the media (who often cannot distinguish between the rates based on the MIS and SRS), these data are a source of enormous confusion and mismanagement.

(2) *How complete is the reporting of child deaths in the MIS?:*

The infant deaths recorded in Maharashtra in the MIS of the health and FW department, and its comparison with the expected number of infant deaths (based on the SRS/Survey of Cause of Death (SCD) reported rates in the state) are presented in Table 8. The table reveals that:

– Overall, only 30 per cent of the expected infant deaths were reported in the MIS;

– For some districts, the reporting was extremely low, for example, Thane 3 per cent, Nashik 5 per cent, Solapur 7 per cent, Nanded 9 per cent.

– The reporting appears more complete in some districts, such as Gadchiroli, Amravati, Yavatmal, Bhandara, Nagpur (rural), with a large proportion of tribal population. This is more likely due to using average IMR for the state to estimate the expected number of infant deaths in each district. In spite of a small correction factor used by the directorate, the expected number is lower for these tribal districts, resulting in apparently more complete reporting. However, why a similar phenomenon did not occur in Thane and Nashik cannot be explained.

– Districts such as Satara, Sangli, and Jalgaon have relatively more complete reporting.

– The estimated IMR for the state based on the MIS reporting was 13.9 for 1999-2000.

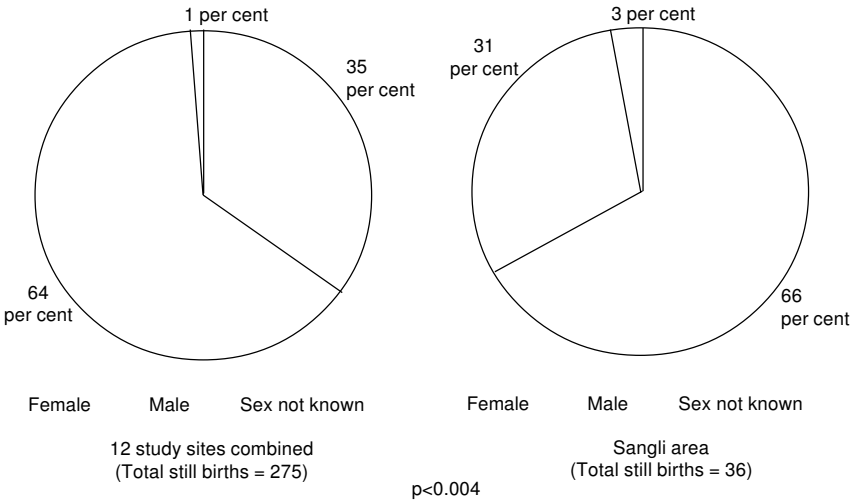
– This table includes only reports from predominantly rural population of 70 million, excluding nearly 26 million mainly urban population. Moreover, the expected infant deaths have been estimated using the IMR reported by the SRS for the whole state (49), when actually the IMR (SRS) for rural Maharashtra (58) should have been used. If that is done, then the completeness of the IMR reported in the MIS was (13.9/58) = 23.9 per cent.

If we use the corrected IMR of 66.7, as estimated in this study (section B), the completeness of the infant death reporting

Table 11: Association of Distance of Village from Bus-stand with Child Mortality Rates

Distance of villages from bus stand (kms)	Live births	NMR	PNMR	IMR	1-4 year Mortality Rate	<5 year Mortality Rate
Same village	3937	48.5	9.9	58.4	11.9	70.4
0.1 - 5.0	3630	51.0	20.1	71.1	12.1	83.2
> 5.0	919	71.8	32.6	104.5	27.2	131.7
Total	8486	52.1	16.7	68.8	13.7	82.5
P		<0.02	<0.001	<0.001	<0.01	<0.001

Figure 9: Comparison of Sex of Still-Born Babies in Sangli with other 12 Study Sites



in the MIS was (13.9/66.7) = 20.8 per cent.

Thus, the infant death reporting in the MIS was only 21 to 24 per cent complete.

3) *Why are child deaths under-reported?*

The reasons which came out in the discussion with the staff of the health department at various levels were:

(1) Failure of the field worker (ANM) to reach every village and every house in her area of 5,000-8,000 population every month;

(2) The ANMs don't conduct most of the deliveries, and hence do not come to know of the births, still births and neonatal deaths;

(3) Traditional dais who conduct a majority of the deliveries are not involved in reporting. There is an incentive scheme to pay the dais Rs 5-10 per birth reported by them. But the money was not delivered to them, resulting in lack of interest.

(4) There appears to be an understanding at the various levels in the health Department that it is safe to under-report still births and child deaths. The lower the better.

(5) The district health officer is the nodal officer (in Maharashtra) who prepares the report on child deaths recorded in the MIS, CRS and also the survey of cause of death. Thus he signs three different reports with varying IMRs for the same district.

(6) The directorate does not question the gross under-reporting or widely varying reports. There is no accountability.

(7) At any level, if a functionary correctly reports the number of deaths, his/her performance stands out as poor because the IMR in his/her area 'increases' in comparision with the earlier low reports. The functionary is held responsible for this 'increase' and is reprimanded.

(8) Reported low rates look good, and suit politicians. Hence they are appreciated.

Thus, under-reporting of still births and child deaths is not punished but rather encouraged, and complete reporting is discouraged.

(D) Causes of Child Deaths

Medical causes of death: The main medical causes of death in 1999-2000 are presented in Table 9.

The major findings in the table are:

(A) Neonatal mortality constituted the largest single 'cause' of death accounting for 58.7 per cent of < 5 year child deaths;

(B) In the post-neonatal age group, that is, 1 month to 5 years:

– Infections – (pneumonia) and diarrhoea – together contributed 56.6 per cent of deaths;

– Malnutrition, which was obvious to the mother was present in 25 per cent of deaths only (this excludes low birth weight in neonatal deaths);

– Immunisable diseases caused only 4.4 per cent deaths. Neonatal tetanus, measles or whooping cough related deaths were uncommon.

Relatively low proportion of deaths attributable to malnutrition is partly due to the method employed (excluding neonatal deaths and assigning malnutrition as the cause only if it was noticeable to the mother), but could also possibly be an effect of the ICDS programme. The small proportion of deaths due to tetanus, measles or whooping cough are attributable to the successful immunisation programme in Maharashtra.

A large proportion (56.6 per cent) of deaths in the 1-59 months age group occurring due to diarrhoea and pneumonia in spite of the introduction of the oral rehydration therapy nearly two decades ago and the case management of pneumonia with antibiotics as part of the ARI control programme nearly a decade ago should cause concern. Though the current rates may be an improvement over the baseline rates, these suggest a large scope for improvement.

Neonatal Mortality: Neonatal deaths contributed 75 per cent of the IMR and 58 per cent of the <5 years mortality in this study. Hence it emerges as the highest priority. Similar concerns have emerged at the national and global levels and new initiatives such as the 'national week of the newborn' or 'saving newborn lives' have been launched in past two years. The current global estimate is 4-5 million newborn deaths each year [Save the Children 2001].

However, the causes of neonatal deaths remain a knowledge gap. Since most neonatal deaths occur at home, unattended by doctors, the cause of death is not certified. Deaths in hospitals may not represent the deaths at home because of the selective type of population and cases which reach hospitals.

In a population-based field trial in Gadchiroli, we found that during the pre-intervention phase, infection (pneumonia, septicemia and meningitis, together called sepsis) was the largest primary cause of death, accounting for nearly half the neonatal deaths. Low birth weight was not included in the primary causes of death. However, its incidence in the study population was 42 per cent and it was present in 90 per cent of neonatal deaths [Bang et al 1999, Bang et al 2001].

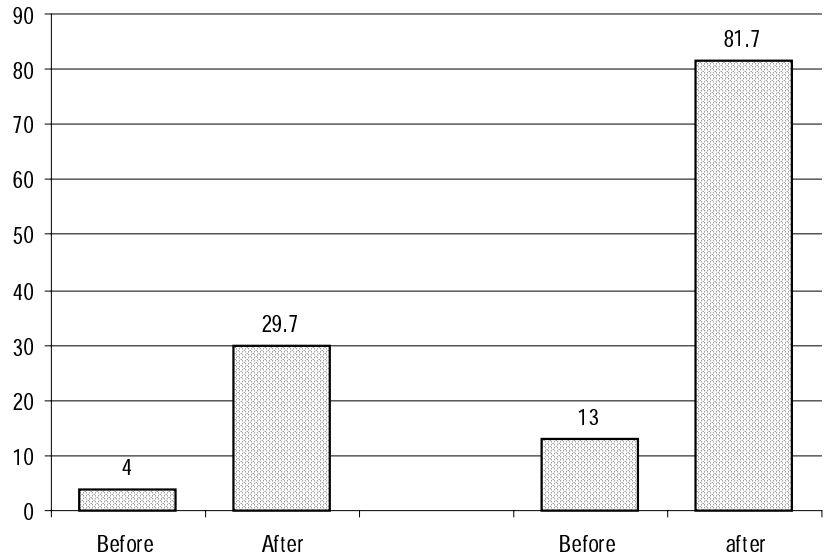
Thus the three major groups of causes of child deaths which need intervention for further reducing the IMR are:

Neonatal deaths, Infections – pneumonia, diarrhoea and neonatal sepsis, Malnutrition.

Socio-economic causes: The IMR and CMR in the CDSAG show significant association with the level of socio-economic development of the population.

The IMR recorded in the six zones in Maharashtra is shown in Figure 8. The level of IMR broadly follows the percent of families below poverty line [GoM 2002]. The comparison of IMR in the least

Figure 10: Effect of an Independent Audit on Reporting by the Health Department (Aheri taluka, Gadchiroli)



Notes: Morality rates: Before the Collector's intervention (1998) and after (2000).

developed eastern region (nine districts of Vidarbha) [GoM 1984] with rest of the Maharashtra is presented in Table 10. The IMR in each strata was higher in Vidarbha than in other regions of the state.

Thus, the eastern region (Vidarbha), tribal areas and urban slums stand out as the worst affected in the state, needing special attention.

The association of distance of the village from the bus stand, as an indicator of the level of development and access to modern facilities, has been assessed on various child mortality rates (Table 11). All rates showed significant association.

Reversed sex ratio: High SBR (41.7) in the study population in Sangli, where 68.3 per cent of deliveries occurred in hospitals, was unexpected (Table 2). Moreover, 66 per cent of the reported 36 still births in Sangli area were female as compared with 35 per cent in other 12 study areas combined ($p < 0.005$) (Figure 9). This suggests a possibility of female infanticide at birth, which is being reported as 'still birth'.

This observation is in consonance with the observed sex ratio in the live births in the Sangli area which was 795/1000 (354 females for 445 male births). The registrar general of India (2001)) has earlier reported Sangli as one of the districts in the country with low sex ratio in children of 0-6 years [GoI 2001]. Thus a strong gender bias against the birth of a female baby is exhibited in Sangli. This might have partly contributed to a lower CBR and higher SBR in the Sangli area than in the other areas in the state.

This suspicion was further corroborated by the fact that all 24 reported female 'still births' in the Sangli area occurred in home deliveries though a majority of the deliveries in that study area occurred in hospitals. Further inquiry revealed that out of the 24 female 'still births', 15 occurred in two out of the total 13 study villages. The SBR in these two villages was computed to be (15/171) 87.7 per 1,000 births, and it was entirely female!

The evidence very strongly suggests a practice of female infanticide at birth. It is possible that those who cannot get selective female foetus abortion done achieve the goal at much lower cost by resorting to this practice at home.

IV
Need for Further Research

(1) The mortality rates in the population observed at 13 sites were:

– Still Birth Rate = 32.1 per thousand births (95 per cent CI, 28.6 to 35.6)

– Neonatal Mortality Rate = 51.2 per thousand live births (95 per cent CI, 46.7 to 55.7)

– Infant Mortality Rate = 68.7 per thousand live births (95 per cent CI, 63.6 to 73.8)

– < 5 Child Mortality Rate = 82.9 per thousand live births (95 per cent CI, 77.3 to 88.5)

(2) The SBR and NMR were nearly 20 points greater than reported in the SRS and NFHS II.

(3) The IMR for the state estimated by correcting the rate reported by the SRS, was 66.2 (95 per cent CI, 61.2 to 71.2).

(4) We estimated the annual number of deaths in Maharashtra to be

– Still births (foetal deaths) = 71,525 (95 per cent CI, 63,500 to 79,375),

– <5 years child deaths, estimated by correcting the SRS reported rate = 175,205 (95 per cent CI, 164,140 to 185,909).

(5) The MIS of the health and FW department recorded and reported an IMR of 13.9 and only 21 to 24 percent of the estimated infant deaths.

(6) The IMR was > 60 at 10 out of 13 study sites.

(7) Neonatal mortality contributed 75 per cent of the IMR.

(8) The IMR and the <5 CMR were significantly higher in the tribal population, in urban slum like areas and in the eastern region (Vidarbha) of the state.

(9) The main causes of child deaths were neonatal deaths, infections – pneumonia and diarrhea – and malnutrition.

The findings and the estimates in this study are indicative and need confirmation. The study generates some new insights and suggests a need to relook at the current estimates.

– Verification of the finding in this study, that the still births and child deaths are grossly under-reported in the MIS of the health and FW department, by way of independent studies with prospective collection of good-quality data in selected population clusters in Maharashtra as well as in other states.

– Evaluation studies to assess the completeness of recording of still births and neonatal deaths in the SRS and NFHS, and in-depth investigation of the possible under-recording.

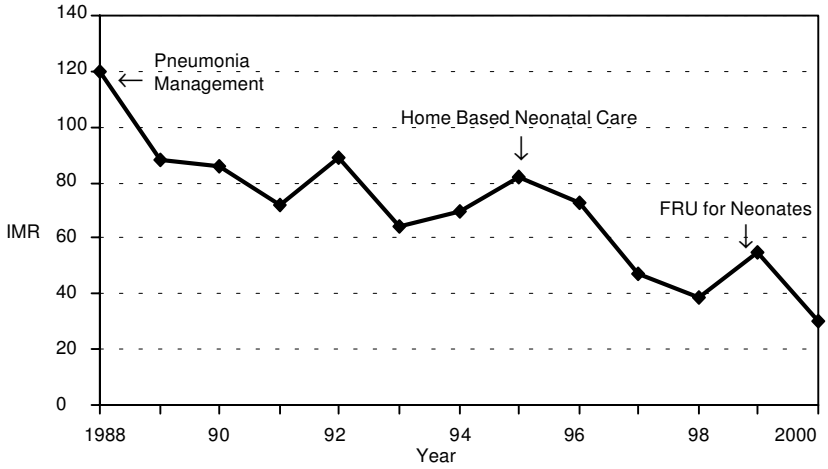
– Re-estimation of the SBR, NMR and IMR. Since 1-4-years mortality and the post- neonatal mortality seem to be recorded more completely in the SRS and NFHS, the method employed in this study to indirectly estimate the IMR based on these rates needs to be assessed for its validity.

– Developing better survey methods to completely record still births and neonatal deaths.

– Further investigations into the sex of the reported 'still births' to assess the occurrence of female infanticide at birth.

– Child mortality rates in urban slums and areas with poor housing need to be

Figure 11: Effect of Interventions on IMR
(39 Villages in Gadchiroli 1988-2000)



measured elsewhere and the causes of deaths, in spite of the accessible hospitals, in urban areas identified.

– The role of the 'social audit' as a method of advocacy on child mortality, and its effectiveness in improving government policies needs to be developed further.

V
In Search of Solutions

The first step to solve the problem of child mortality is to correctly measure it.

Need to completely record neonatal deaths and still births: The SRS and NFHS estimates are widely used for policy-making and planning. If the indications of this study are valid, then the SRS and NFHS both need to improve procedures, especially for complete recording of neonatal deaths and still births. The reasons for under-recording need to be identified and corrected. In-depth study should be instituted for this purpose. The current Civil Registration of Births and Deaths Act puts the onus of registering the event of birth or death in rural areas on the family. However, in a predominantly illiterate population, the family members fail to do so, especially because they have nothing to gain and a lot of time to lose in registering the birth or death with the gram sevak, who is the registering officer at the village level but who erratically visits the village for a few days in a month. Therefore the child death registration in the CRS in Maharashtra is only 29 per cent [CR's 2002]. The rules need to be amended, and under Section 8(2) the responsibility of recording births and child deaths should be entrusted to the female health worker (ANM) who, anyway, is expected to register all pregnancies and provide care to mothers and children. We have already discussed why, in spite of the sample estimates such as SRS or NFSH, it is vital for the effective management of the health and FW department to record births and child deaths in the MIS and the reasons of under-reporting.

Corrective measures for complete reporting of child deaths in MIS: In spite of the civil registration system, the health and FW department must record all births and deaths.

– A goal of 100 per cent recording of child deaths should be set by the health and FW department. The onus should be put on the functionaries who are paid for the job and not on the aggrieved family which has suffered a child death.

– The functionaries of the department should be encouraged to make complete reporting.

– Accountability for under-reporting of child deaths must be established in the health and FW department at every level.

– Information from dais and key village informers including ICDS workers and gram sabha should be collected by the ANM.

– Child deaths in the village should be displayed on a board in the village and presented in the gram sabha meeting and the community encouraged to add the missed deaths.

– Every child death should be inquired into by the medical officer of the primary health centre, the gaps or lapses identified and corrective actions initiated.

– The collector of the district or the chief executive officer of the zilla parishad, both of whom are outside the health and FW department, should review the child deaths reported by the health department, ICDS and the civil registration system, and prepare a combined list using the information from these three sources. Such a review or 'child death audit' can have a dramatic effect on the completeness of reporting. An experience from Gadchiroli provides an evidence: the collector independently measured IMR in the tribal Aheri block in the district in 1998, reported it to be 118 to the state government, and also pointed out that the IMR reported by the district health office for the previous five years was extremely low – only 13. Though the collector was transferred, the impact of such independent measurement and review on the IMR reported in the MIS of the health department is shown in Figure 10.

– The MIS data should be actively scrutinised and used by the directorate.

– The child death reports of the MIS of the health department should be annually evaluated by an external agency, preferably by the office of the Registrar General of India, SRS, Government of India, and made public.

– A paradigm shift needs to occur in the casual way the under-reporting is viewed today. Not reporting a child death or generating incomplete data on child mortality should be looked at as misconduct more serious than financial corruption because life is more valuable than money. A social audit of child mortality reporting should be considered mandatory at every level – from the village to the state. The health and FW department should establish an accountability system internally as well as become accountable externally.

In the Section 7, we describe the case study of the effect of 'social audit' as a method of introducing administrative reforms.

A new strategy to reduce IMR: There is evidence from two field trials [Bang et al 1990, Bang et al 1999] conducted in sequence (1988-1990, and 1995-98) in rural Gadchiroli about the feasibility and effectiveness of a strategy to reduce the IMR.

Village health workers and dais (TBAs) were trained in 39 villages to perform following functions:

(a) Health education and management of pneumonia in children (1988 onwards);

(b) Provide health education to families, monitor the neonates for high risk or sicknesses and manage sick neonates at home (1995 onwards);

(c) First referral level care for very sick neonates in a small rural hospital (1999 onwards).

The indicators of community acceptance, coverage and quality were excellent. The effect on the IMR is presented in Figure 11. IMR declined from 121 in 1988 to 30 in 2000. Incidentally, reducing IMR to < 30 by 2010 is the goal of the National Population Policy. Gadchiroli is the poorest and remotes district in Maharashtra. Without any non-health inputs, the IMR could be reduced to 30. Hence this offers one possible model for the new strategy.

The advantages of this strategy are:

– It is community-based in harmony with the principles of primary health care, as accepted in the Alma Ata global declaration;

– It utilises and depends on developing the human potential in villages – mothers, village health workers and dais – and is not dependent on employing urban-trained educated class which is unwilling to go to rural areas and is costly.

– It is need-based, and fulfills the demand for available and accessible health care in villages. Hence, it is highly acceptable to people.

– It is very effective in reducing the NMR, IMR and CMR by large margins.

– The cost is low; nearly Rs 250 per newborn baby, or Rs 5,000 per averted death [Bang et al 1999]. This is lower than the cost of most healthcare interventions when converted into the cost per life year saved [World Bank 1993].

Social-Economic Development: This is of course the basic solution to so many ills including child mortality. The evidence in CDSAG shows significantly higher IMR in tribal population, in the underdeveloped Vidarbha region, and in the urban population living in slums. Similarly, the reversed sex ratio in the ' still births' suggests gender bias against female babies. These all need socio-economic measures.

VI
Conclusions

(A) Within the limitations of its sampling method, this study presents the micro-level evidence from 13 sites to suggest that the IMR and child mortality are under-recorded and under-estimated.

– The neonatal mortality rate, IMR and still birth rate are each underestimated by nearly 20 points in the SRS and NFHS. This needs verification. If this is found to be true, re-estimation of these rates may be needed. We have attempted such an exercise.

– The corrected IMR for Maharashtra is estimated to be 66.2, and the SBR to be 31.5. The total annual child deaths in the state are estimated to be nearly 1,75,000, and the still births 71,000.

– The MIS of the health and FW department of the state government is woefully incomplete, recording only 21-24 per cent of infant deaths.

These are grave problems and need serious policy and programmatic responses.

(B) Four other issues which emerged in this study are:

– High neonatal mortality, contributing nearly 75 per cent of the IMR, and the high still birth rate: The maternal and child health and development programmes need to redefine their priorities and identify appropriate and effective intervention strategies. In view of the goal of the National Population Policy to reduce the IMR to < 30 by the year 2010, this becomes a high priority.

– High child mortality rates in the tribal areas and urban slums: The geographical and social distance result in inaccessibility and unacceptability of the health services to these two population groups. Strategies to overcome these barriers need to be developed. Culture-sensitive, community-based health services may be the answer.

– The Vidarbha region revealed significantly higher IMR than the rest of the state. Thus, in addition to the 'development backlog' of this region which has been earlier estimated and has become a basis of allocating developmental resources, the 'child survival backlog' of this region also needs bridging.

– The reversed sex ratio in 'still born' babies, suggesting female infanticide, compounds the problem of selective abortion of female foetuses. An aggressive social response is necessary.

(C) The possible solutions suggested to the twin problems of high child mortality and its under-counting are:

– The SRS and the NFHS need in-depth investigation into the possibility of, and if confirmed, then into the reasons for under-recording neonatal deaths as well as still births, and introduce corrective measures.

– To make the MIS a valid instrument of monitoring the performance of health and child survival programmes it needs to be radically revamped. We have suggested some corrective measures.

– An independent recording of the vital rates outside the government and the official statistical systems, the so called 'social audit,' seems to be an effective way of focusing on the problems of invisible child deaths, and initiating corrective political and administrative measures.

– A community-based health care strategy utilising the human power from the villages: This approach, developed and tested in two field-trials in Gadchiroli, has succeeded in reducing the IMR to 30, which the National Population Policy aims to achieve by 2010.

(D) The issue of child deaths is important for India for three reasons. One, it is the most poignant human rights issue, of the right to live. Two, the 'human capital' is the main asset of a developing country like India. The survival and well-being of this 'capital' is crucial for growth and development. And last, it is the acid-test of democratic governance which must demonstrate the ability to identify the failures and institute corrective mechanisms.

Thus, the issue of child deaths is important ethically, economically and politically. It is not surprising that the infant mortality rate is such an important component of the human development index.

VII
Beyond Research: Social Audit of Child Mortality

The CDSAG study had a dual purpose. One is to answer certain research questions, listed under the 'Study Objectives'.

However, the research findings often fail to have the desired impact on policy. We have described the initial findings of the district collector of Gadchiroli on under-recording of child deaths. Even the additional director, vital statistics, department of health and FW, recorded the gross under-reporting of infant deaths in the health department [GoM 2000]. A semi-official report on this issue prepared on the request of the regional statutory development board (Vidarbha Vaidhanik Vikas Mandal), government of Maharashtra, was accepted without any change by the highest authority in the health and FW development and was submitted to the state governor of Maharashtra [Bang 2001a]. Yet, no corrective measures followed. The Registrar General of India and innumerable researchers have repeatedly pointed out the under-reporting of births and deaths. These warnings usually had fallen on deaf ears. The wall of silence and inaction was impenetrable.

Therefore, the second purpose of the CDSAG study was to trigger the social and political forces outside the research and technical fraternity, to ensure the necessary corrective response of the administrative system. Hence, we called this study 'A Social Audit of Child Mortality in Maharashtra'. In this section, we describe the method and the results of this 'social audit.'

Information is power and it can be harnessed as a tool for social change; in this case, for reforming the child death reporting in the health and FW department of the government of Maharashtra.

Since children themselves do not have a political voice or a nuisance value, the potential target audience was thought to be the media, voluntary organisations, public opinion, politicians and the bureaucracy in Maharashtra.

The study was conducted by forming an alliance of NGOs in the state, named 'Child Death Study and Action Group (CDSAG), Maharashtra'. Funding support came from agencies CRY (Child Relief and You) and Swiss-Aid, who shared concern about unreported child deaths. The local communities from whom the data was collected were informed of the purpose and were involved in the study. The report of the study was published in Marathi under the title `Kowali Pangal' ('The fall of tender leaves') on November 24, 2001.

An effort was made to reach out to people through the media which gave the report prominent and wide coverage. All major Marathi newspapers published the news as well as editorials on the study within one week (November 24-30, 2001). Television also gave wide coverage. Copies of the printed report were sent to nearly 500 prominent citizens, social workers, voluntary organisations and politicians in the state.

The rapid build-up in the media, emotionally appealing nature of the issue of child deaths, evidence in the form of concrete data, and the forthcoming session of the state legislative assembly probably forced the administration to take urgent notice of the report. One can be certain about the contribution of the sensitive officers within the government. A series of meetings with the chief secretary, health and FW minister, and finally with the chief minister followed in rapid succession within one week. (November 30 to December 5.) While the health and FW department's officers, understandably, took a defensive posture, and the health minister was also obliged to take a similar view, the bureaucracy from the other departments agreed with the findings and the main messages of the study. Leaders of the opposition in both the Legislative Houses and 48 members of the legislative houses gave notice for a special emergency discussion in the house on the shocking findings of the report.

The chief minister, in a prolonged meeting with the researchers and the concerned ministers and officers, on December 5, expressed agreement with the main message of the study and accepted the goal of 100 per cent recording of child deaths in future and most of the corrective measures recommended by the study. He also accepted the recommendation to start pilot projects in the state to reduce child mortality using the approach of home-based neonatal care, and instructed starting such projects in the 14 worst affected districts.

On December 12, a resolution of the Government of Maharashtra (strangely, by the rural development department) was published which emphasised the goal of 100 per cent recording of births and child deaths and listed various corrective measures accepted by the chief minister [GoM 2001]. The most important of these were: (i) to share the list of dead children with the village community by publicly displaying on a board and in the gram sabha so that the community could add/correct the list; (ii) formation of block-level and district-level committees headed by the block level chairman of the panchyat raj body, and at the district level, by the collector. The underlying assumption is that since these politicians/officers are not part of the health and FW department, they will have no interest in covering up the under-reporting, and they will insist on complete reporting and review of the child deaths.

The issue was also discussed in both legislative houses. The health and FW Minister, replying on April 24, 2002 in the legislative council, took an ambivalent position. On the one hand, he denied the findings of the study. He also absolved the health and FW department from the responsibility of child deaths because, according to him, high child mortality was the product of wrong socio-cultural customs and behaviour. He also asserted that his department had initiated steps to improve child death recording which had improved the recorded deaths from 3,000 in 1996 to 30,000 in 2001-2002. (as against nearly 1,75,000 child deaths estimated in this study). Clearly, the officers in the department had convinced him that recording 30,000 child deaths was a good performance.

The researchers had recommended the annual review of child death reporting in the health and FW department by the Registrar General of India, and making the findings public. Instead, the government has announced that some other agency will be given an assignment to prepare a report on this issue. However, the terms of reference and the methods have not been made public. It is to be seen whether this proposed assignment takes the issue further or the government uses it as a shield to justify/absolve itself.

The main outcomes of this 'social audit' have been:

(1) Public attention and awareness in the state. The media has been extensively sensitised.

(2) Sensitisation of the politicians and bureaucracy. The chief minister agreed that child deaths were under-reported, and accepted the goal of 100 per cent recording. The director, Tribal Research Institute, Government of Maharashtra, and the commissioner, Aurangabad Division, have subsequently independently assessed child deaths in different parts of the state and made their findings available to the media. Both have concluded gross under-reporting of child deaths by the department of health and FW [TNN 2002, *Loksatta* 2002].

(3) The administrative decisions published in the GR of December 12, 2001.

(4) The decision by the chief minister to start pilot projects to reduce child mortality in 14 districts.

(5) The 13 NGOs who conducted the study have moved further and launched a new intervention project, named 'Ankur' ('The Sprout') to save newborns and children by introducing community-based healthcare.

Though the 'social audit' approach was effective in moving social opinion and the apathetic system, it also generated passions, and understandably, a defensive reaction from the health and FW department as it was held responsible for the problem. It is to be seen whether the decisions announced by the state government are implemented sincerely and result in the improved recording of child deaths in the health and FW department, and ultimately, in the reduction of child mortality. EPW

Address for correspondence:
search@satyam.net.in

Appendix I
Definitions

1	Crude birth rate (CBR)	= Number of live births in a year per 1,000 population
2	<5 Child mortality	= Death of children before the age of 5 years.
3	<5 Child mortality rate (<5CMR)	= Number of deaths of children below the age of 5 years per 1000 live births in that year.
	<5 Child mortality rate is composed of three components depending on the age at deaths.	
3	(i) Neonatal mortality rate (NMR)	= Number of deaths of newborn babies during first one month (0-28) days after birth per 1,000 live births in that year.
3	(ii) Post neonatal mortality rate (PNMR)	= Number of deaths of infants of the age 1 month (28 days) to 1 year (365 days) per 1,000 live births in that year.
	Infant mortality rate (IMR)	= Number of deaths of children of the age 0-365 days (less than one year) per 1,000 live births in that year. IMR thus is a sum of 3 (i) and 3 (ii).
3	(iii) 1-4 year mortality rate	= Number of deaths of children between 1 year and before completing 5 years of age per 1,000 live births in that year.
4	Still birth rate (SBR)	= Number of still births per 1,000 deliveries in that year. Still birth is defined as birth of a dead baby (foetal death) after completing 28 weeks of gestation un uterus. These deaths are *not* counted in the IMR or CMR, but are included in the perinatal mortality rate.
5	Perinatal mortality rate (PMR)	= Still births + early neonatal deaths (when the neonate is less than seven days old) per 1,000 births.

Appendix II
Survey Forms Used

(1) Village information form; (2) A register of the families in the village; (3) Family survey form; (4) Birth registration coupon; (5) Death registration coupon; (6) Birth certificate; (7) Witness; (8) Attestation from sarpanch; (9) Verbal autopsy of cause of death; (10) Survey report form.

[The study was jointly conducted by various non-government organisations. Their heads were the co-investigators in this study. Similarly, Green-Earth Consulting, Pune, was the collaborator. This paper has been written by us on behalf of this joint group, called, the Child Deaths Study and Action Group, Maharashtra.

The study was made possible due to participation by the people in 231 villages and six urban slums, community workers, supervisors from 13 NGOs and members of the research team of SEARCH and Green-Earth.

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