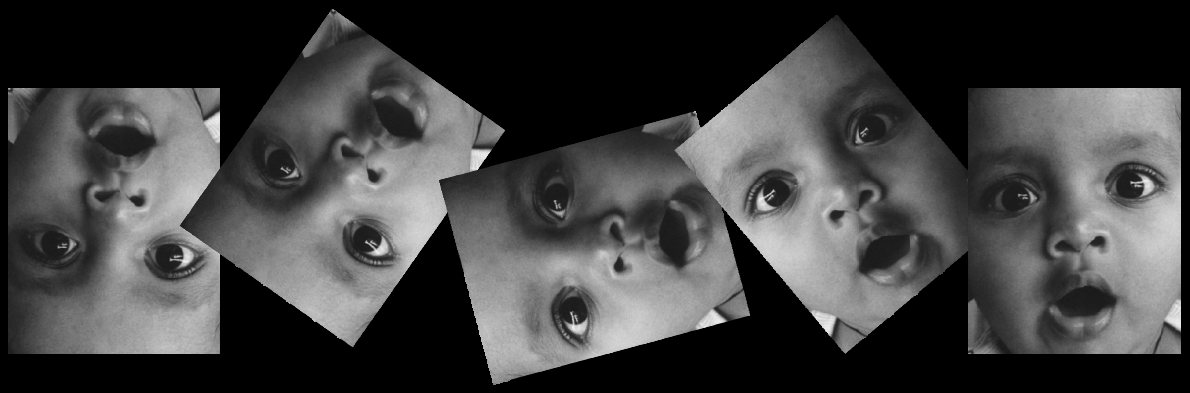

Hidden

Child Mortality in Maharashtra

A multi-site field study of under-estimation in government statistics and an alternative estimate of the infant mortality rate

By

Abhay Bang

Hanimi Reddy

Mahesh Deshmukh

Published by
The National Commission on Population, Ministry of Health and Family Welfare
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For

The Child Deaths Study and Action Group, Maharashtra

Foreword

J K Banthia, IAS, Ph D

Former Registrar General and Census Commissioner,
Government of India.

Published by

**The National Commission on Population,
Ministry of Health and Family Welfare
Government of India.**

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Foreword

Almost all regions of India, barring Kerala, have high levels of infant and child mortality, when compared with those of advance countries. The National Population Policy 2000 has stressed on the need to bring substantial reduction in infant mortality rate (IMR). The successive Five Year Plans have also targeted reduction in IMR. The variation across the country in the levels of IMR, is very high and needs to be controlled and removed. The reasons for these high levels include neonatal tetanus resulting from unhygienic delivery practices, lack of knowledge and practices regarding proper infant care, etc. The primary health infrastructure has also not developed in a uniform manner. In a large proportion of the villages it is still difficult to get proper health care, especially in times of emergency mainly because of the distances to the nearest facility and lack of availability of proper transport. In the above situation alternate approaches that can help in bringing down infant and child mortality assumes importance.

The country also lacks regular information on infant and child deaths at the sub-state levels. The Sample Registration System (SRS) operated by the Office of the Registrar General, India is the only source that Provides continuous data on infant and child mortality rates. However, due to the limitations of sample size, it is not possible for SRS to provide reliable estimates at district and lower levels. In the absence of reliable data on these parameters at the district and sub-district levels, it is neither possible to prepare proper action plans for reduction of infant and child mortality nor monitor the impact of localized action plans. The Civil Registration System in India with the legal backing of the Registration of Births and Deaths Act of 1969 and the rules framed by the states is designed to generate such statistics. But unfortunately, even after thirty years of its implementation, a large number of births and deaths in certain parts of the country go unregistered. The level of under registration of both the birth and death is much higher in case of infant and child population due to variety of reasons. This inefficiency of the system to ensure 100 per cent registration of all births and deaths has lead to the lack of quality data on Birth Rate, Death Rate, Infant Mortality Rate, Still Birth Rate, at the district and lower levels in several states.

The CDSAG (Child Death Study and Action Group) initiative involved 13 voluntary organizations from different parts of Maharashtra who participated in this study covering 231 villages and 6 slums. The sample was purposive and out of 13 study sites Nasik, Amaravati, Nagpur, Gadchiroli district had two sites each. It is important to note

here that the more urban, developed and heavily populated region of western Maharashtra was inadequately represented. The precise impact of non-inclusion of this area is difficult to assess which has relatively low infant and child mortality. Notwithstanding this, the findings from CDSAG survey are important both from the view point of estimating the vital rates and also from policy perspective. While CDSAG survey suggests that the IMR in Maharashtra was around sixty six per thousand, the reported SRS (1998) and NFHS II rate is much lower. Just because the SRS and NFHS II rates are in close agreement with each other it would not justify accepting these rates as a true reflection of the ground reality. The Office of the Registrar General, India is very much aware that there is scope for improvement in estimating both the birth rates and the death rates from the SRS, as children dying early in life are likely to be under reported both for births and deaths. It is expected that this study will provoke both the CRS and the SRS to examine the vital rates generated from these systems and explore the possibility of improving. While it is important that the target set under NPP 2000 for reducing IMR and CMR are achieved, it is crucial that the bench mark for future referencing on these two vital rates is robust. Further, the tools required for continuously assessing these vital rates need to be improved and strengthened in the country so that realistic assessment can be made of the programme impact for reducing infant and child mortality across the country. The importance of CDSAG study and its findings, therefore, in my view lies in provoking the Union Government and the State Government to strengthen the offices of the ORGI and the Chief Registrar of Births and Deaths to enable them to put in public domain realistic estimates of vital rates both at the State and District level. The efforts of CDSAG study needs to be commended and deserve to be replicated in other parts of the country. The advice, however, is to have a larger and more representative sampling design. The necessity to replicate the study in the same area over a period of time is crucial to understand whether these sample surveys can play a meaningful role as an alternative to the estimates produced by the State agencies.

The work done by Dr. Abhay Bang and his organization in the area of controlling infant and child mortality and collecting data thereupon is a path-breaking one. Involving the community and community level workers has been experimented with very good results. How much of this can be replicated on a large scale across the country is debatable but worthy of giving a chance. What has been achieved by a motivated team of workers in small areas may not be achieved, if copied to other areas, without the key ingredients that made it into a success. There can be a genuine difference of opinion with regard to some of the suggestions like the necessity of an independent social audit outside the Government

system of data collection. Considering the fact that Birth and Death Registers maintained under the Registration of Births and Deaths Act are public documents, it is necessary to work out improved strategies to ensure recording of all births and deaths.

Many a times efforts of this nature go unpublished and the knowledge gained is not spread to others working in the same area. This results in several people trying to achieve the same thing and trying to get similar experiences. I hope that this publication would result in wider dissemination of the strategies for reduction of IMR and recording of child deaths with appropriate modifications required in various parts of the country. This would help in the reduction of IMR as well as improvement in the birth and death registration system.

Registrar General and
Census Commissioner, India
New Delhi, the 11th November, 2003

(J.K. Banthia) 13/11/

Acknowledgement

This 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, 200 community workers, 26 supervisors from 13 NGOs and members of the research team of SEARCH and Green-Earth.

We also thank the following persons who reviewed the draft at various stages and gave valuable criticism and suggestions : The office of the Registrar General of India, SRS, Government of India, New Delhi, Prof. Anil Gore, Anil Kharshikar and J V Deshpande of the Department of Statistics, University of Pune, Prof. K Ramachandran, Chennai, Dr. Leela Visaria, London, Dr. M D Gupte, Director, National Institute of Epidemiology, Chennai, Dr. Dileep Mavlankar, Public Systems Group, IIM, Ahmedabad, Dr. Anant Phadke, Pune, Mr. Sada Dumbre, editor, Saptahik Sakal, Pune, The director and the faculty of the International Institute for Population Sciences, Mumbai.

CRY and Swiss-aid financially supported the study. We are grateful for their support to the study and the cause.

Dr. J.K. Banthia, Registrar General and Census Commissioner, Government of India, was open towards a study which pointed out flaws in the statistics of his department. This is a rare quality. He and his colleagues in the office of the Registrar General, discussed the findings of the study, checked and corrected when necessary, and in the end, he accepted the invitation to write the foreword to this study.

Ms. Meenakshi Dutta-Ghosh, Secretary, National Commission on Population, and Mr. Prasanna Hota, Secretary, Ministry of Health and Family welfare, Government of India, offered to publish and disseminate this study. We are grateful to the Government of India for this.

Preface

"One accurate measurement is infinitely superior to a thousand intelligent opinions."

This study is an outcome of a belief - it is unethical not to count a child death.

Death of a child is a tragic violation of human right, the right to live ! Not to count that death compounds the tragedy because it prevents the possibility of initiating corrective measures to avoid future deaths. Conversely, beginning to count every child death can generate the statistical evidence and human passion to move the society to save the dying children.

The main finding of this study is the gross under-reporting of child deaths by the state government. The data from this 13 site field study are further used to estimate the infant mortality rate and the true number of child deaths in Maharashtra by correcting the estimates made by the Sample Registration System, Government of India. These corrections may be of wider interest and significance.

How did we hit upon this journey ?

Measurement of child mortality rates in our field research area of nearly 100 villages in Gadchiroli (Maharashtra) for 10 years brought us in 1998 face to face with the problem of gross under-reporting of child deaths in government statistics. Since the issue is important for the planning of health services, allocation of resources, measurement of the human development index, and finally, for safeguarding the human rights of children, we decided in 1998 to conduct a field study and social audit of the issue.

With other non-government organizations in the state, we formed 'The Child Deaths Study and Action Group, Maharashtra'. During 1998-2000, this group conducted a 13 site field study of the true magnitude of child mortality in 231 villages and 6 urban slums in Maharashtra.

This study was first published in Marathi in November 2002 under the title 'Kowali Pangal', (literally, the shedding of tender leaves). The study and its main findings that nearly 200 thousand children die every year in Maharashtra, and worse, the official statistics of the Health and Family Welfare department of the state records only 20% of these deaths received a major media coverage and sparked two debates in the state legislative house. The Chief Minister of Maharashtra, after a prolonged meeting with the

research team, accepted all recommendations in the report, and a GR (Government Resolution) was published within 20 days of publishing the study.

Due to the lack of random sampling, the findings and the interpretations in this study had to be considered with caution, especially while generalising them. We tried to make corrections for this limitation. Further analysis was made to overcome this limitation by weighting, and by estimating using indirect methods. An attempt was made to estimate the true infant mortality rate and the total child mortality in Maharashtra by correcting the estimates of the Sample Registration System, Govt. of India which are based on a larger randomly selected sample. The revised version was published in the 'Economic and Political Weekly', (7 12 December, 2003).

More recently, data collected by us in one field site in Nashik district for the subsequent research revealed that, though these 14 villages were considered by us as 'tribal' because the government statistics said so, a house to house census revealed them to be predominantly non-tribal. This new information has been incorporated in this publication, resulting in some modification in the proportion of the tribal and rural populations, and the child mortality rates in these two population groups.

This study has been sometimes criticized for the lack of random sampling. We accept this limitation. However, to refuse to look at a new evidence just because it is not based on random sampling is a knee-jerk response. The national surveys based on random sampling seem to suffer from operational problems in collecting data in the sampled communities scattered widely. This runs a serious risk of loss of quality in the collected data. We have made an effort to overcome this difficulty by collecting high quality data with good internal validity at 13 clusters of population selected from different strata, and then used the generated insights to correct the larger national survey, the Sample Registration System, which has excellent method of sampling and hence good external validity.

Thus, this study can be looked at as a collection of 13 micro-studies of good quality, the findings of which, when used to correct the estimates of the Sample Registration System, yield the estimates of the true infant mortality rate and child mortality in Maharashtra. The final estimates are based on the corrected Sample Registration System. In doing so, the study also yields the estimates of under-reporting in the still birth rate, neonatal mortality rate and the infant mortality rate in the Sample Registration System.

We hope that the study findings will be used by the official agencies and policy makers as the pointers.

We hope to generate three responses.

- The agencies which measure the infant mortality and child mortality rates consider these findings, and if necessary, initiate corrective measures in their methods of estimating.
- The policymakers appreciate the true magnitude of the infant mortality rate and of the problem of child mortality, especially of the hidden still births and neonatal deaths, and initiate appropriate programme responses.
- The social sector- NGOs, media, human rights advocates, pediatricians, -and the elected political representatives take up the cause of hidden child deaths for advocacy and action to save these children.

The findings of this study were extensively used by the 'Committee to Evaluate Child Mortality', appointed by the Government of Maharashtra in 2004. The reports of the committee have been accepted by the state government. The Chief Justice, High Court, Mumbai has suo-moto initiated a public interest litigation on the issue of malnutrition and child deaths in the state reported in media and in this study. The government of Maharashtra has promised to implement the findings and the recommendations of the above committee.

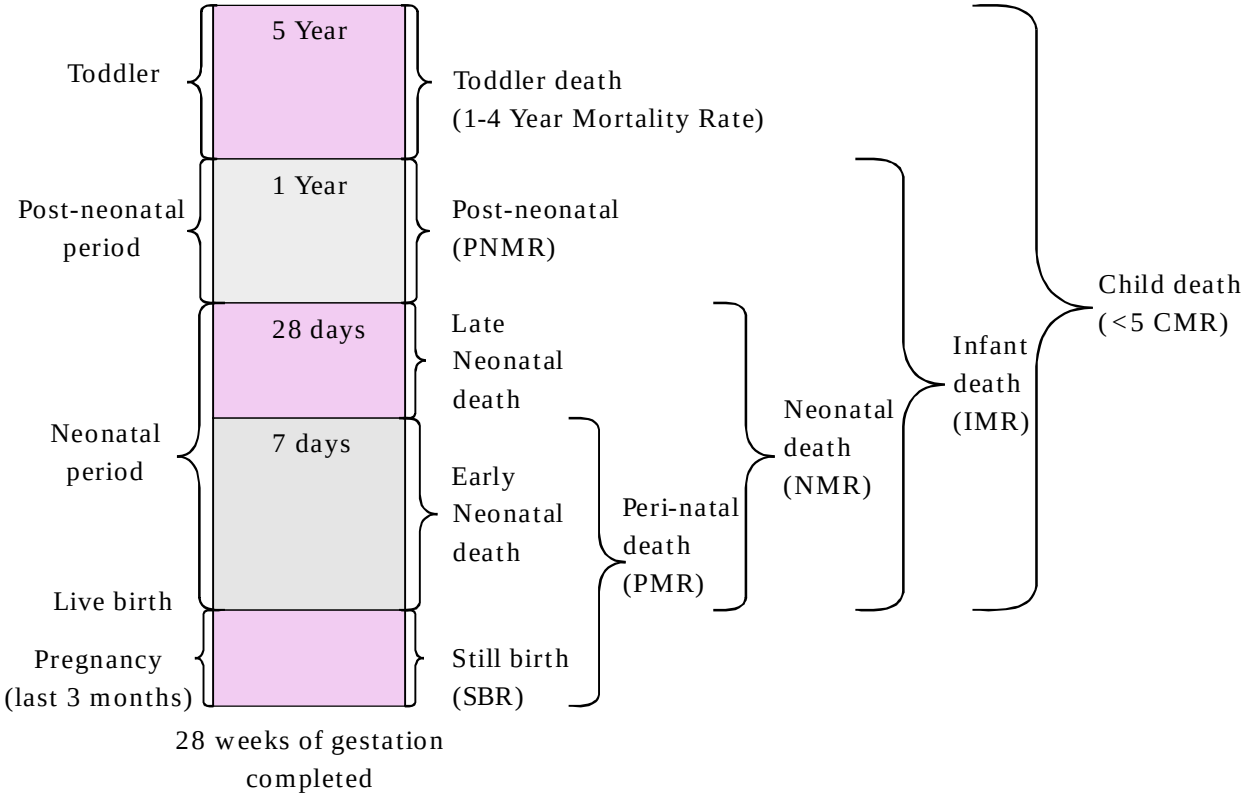
Thus, the findings of this study have already made an impact on the government policy in Maharashtra.

We are very pleased that The National Commission on Population, Ministry of Health and Family Welfare, The Government of India is publishing this report. We hope that the findings will help initiate a process of examination of the issue, and if necessary, correction in various states and in the center.

If knowledge is power, by definition, the power must initiate a change.

Shodhagram, Abhay Bang
Gadchiroli, 442-605.

Different periods in childhood (and the corresponding mortality rates)



Definitions

1. Crude Birth Rate (CBR) = Number of live births in a year, per 1000 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 death

3.i) Neonatal Mortality Rate (NMR) = Number of deaths of new born babies during first one month (0-28 days) after birth, per 1000 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 1000 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 1000 live births in that year. IMR thus is a sum of NMR and PNMR.

3.iii) 1-4 year Mortality Rate = Number of deaths of children between 1 year and before completing 5 years of age, per 1000 live births in that year.

4. Still Birth Rate (SBR) = Number of still births, per 1000 deliveries in that year. Still Birth is defined as birth of a dead baby (foetal death) after completing 28 weeks of gestation in 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 1000 births.

Executive Summary

Background :

During the past decade, media repeatedly reported outbreaks of child deaths from different parts of Maharashtra, but the government figures did not reflect these. Under-reporting of child deaths can mislead the entire process of planning, program management and can prevent corrective action. Hence, the Child Deaths Study and Action Group (CDSAG), involving 13 non-government organizations (NGOs) from different parts of Maharashtra, undertook this study.

Aims of the study :

To answer following questions –

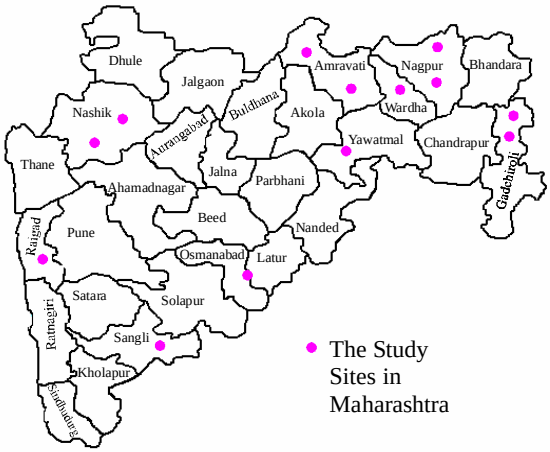
1. What is the true IMR and the magnitude of child deaths and still births in Maharashtra ?
2. What are the child mortality rates in rural, tribal and urban areas in Maharashtra ?
3. What is the extent of under-reporting of IMR in the MIS of the Health and FW department of the state ?
4. What corrective measures are necessary for complete reporting of child deaths ?
5. What are the main causes of child deaths ?

Methods :

The sample population was selected b stratified cluster sampling. Different strata in th population of the state were first selected. The the individual clusters (13 study sites) in seve strata were selected by convenient samplin Total sample population at 13 study sites wa 2,26,904 in 231 villages and 6 slums.

200 community workers, under th guidance of 26 field supervisors, collected vit statistics by visiting every house 4 times durir the two years of the study period (November 1998 to October 2000). Each recorded birth was verified by supervisor and each child death was attested by the parents and the community leaders.

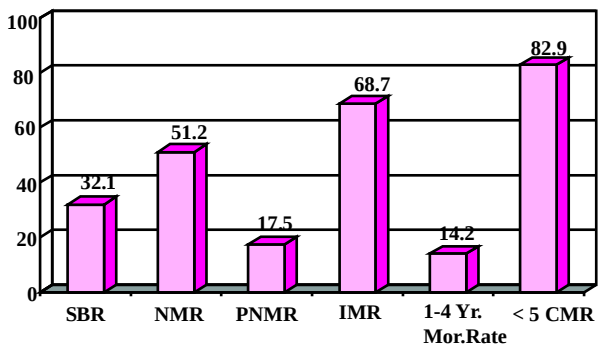
The study sites in Maharashtra



Results :

- Total live births 9377, (Crude Birth Rate 20.7)
- Total still births 311 (SBR 32.1)
- Total child deaths 777 (Neonatal mortality rate (NMR) 51.2 , Infant mortality rate (IMR) 68.7, Under 5 child mortality rate (<5 CMR) 82.9)
- The NMR contributed 74.5% of the IMR

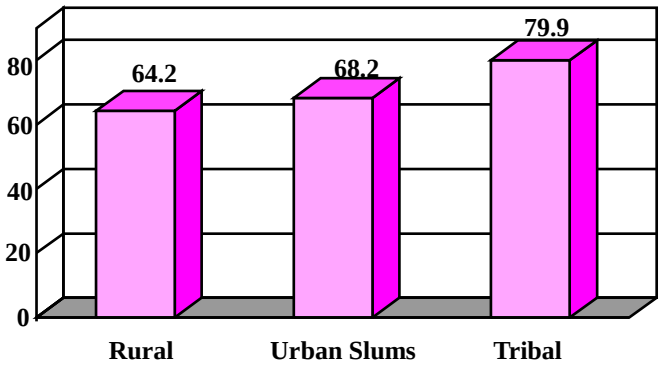
Still Birth Rate and Child Mortality Rates in CDSAG study



- IMR in different types of areas was :

Rural	64.2
Tribal	79.9
Urban slums	68.2

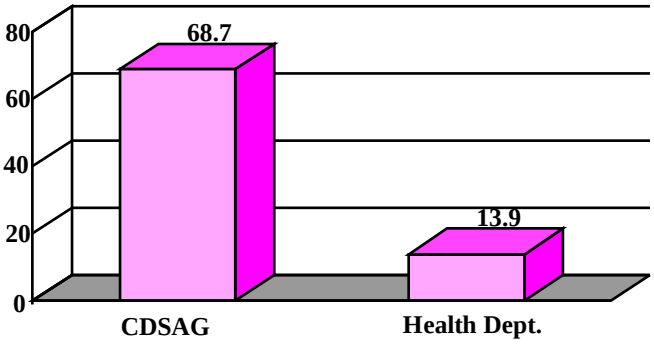
IMR in three types of areas



Comparison with other estimates :

i) The MIS of the Health and FW department of the Government of Maharashtra (GoM) recorded only 20-25 % of child deaths.

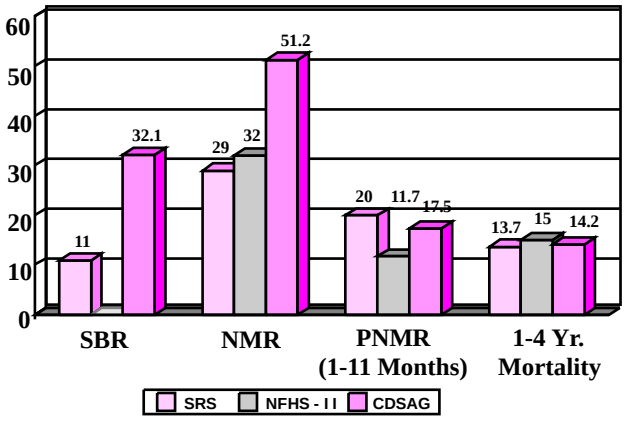
Completeness of the IMR reported by the Health Department of the state.



ii) Though the study population was not selected randomly, the findings, based on 13 micro-studies of good quality, can be used to test the validity of other estimates for Maharashtra.

Comparison of the findings of this (CDSAG) study with the estimated rates for Maharashtra by the Sample Registration System (SRS) 1998, and the National Family Health Survey (NFHS-II) revealed that the birth rate, the, post-neonatal and the 1-4 year child mortality rates were similar, but the SBR, NMR, and IMR each was nearly 20 points higher in the CDSAG study.

Child Mortality Rates in Different Surveys

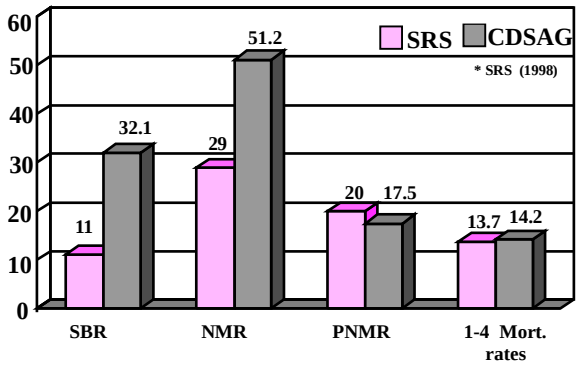


Under-estimation of SBR and NMR :

The SRS probably misses a large proportion of still births. It also misses neonatal deaths and hence underestimates the IMR.

A comparison of the IMR in various estimates showed that the SRS and NFHS under-recorded the IMR by nearly 20 points.

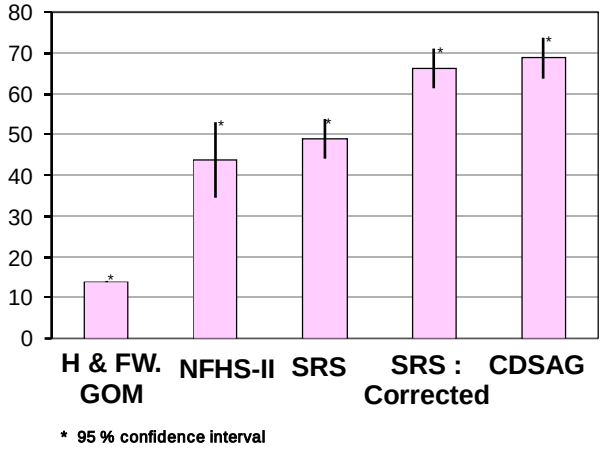
CDASG and SRS*



Corrected estimates of the IMR :

Due to the non-random sampling, the study population in the CDSAG study may be unrepresentative. Hence, alternative estimate of the IMR was calculated by correcting the SRS estimate. The corrected IMR was 66.2

The Estimated IMR from different sources



Total annual child deaths in Maharashtra :

Based on the corrected estimates in this study, the total number of deaths each year are -

Still births 69,484

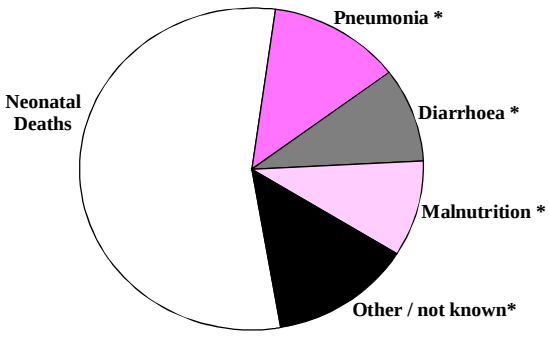
Child deaths 175,025

Causes of child deaths:

	%
1. Neonatal deaths	- 58.7
2. Pneumonia*	- 13.2
3. Diarrhoeal diseases*	- 10.1
4. Malnutrition*	- 10.4
5. Other /not known*	- 14.3

(* Excluding neonatal deaths.)

Cause of Child Deaths : 1999-2000



Corrective Measures :

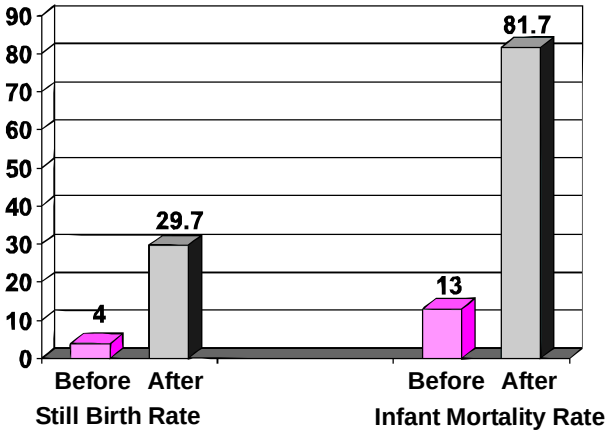
(A) For complete recording of births and child deaths.

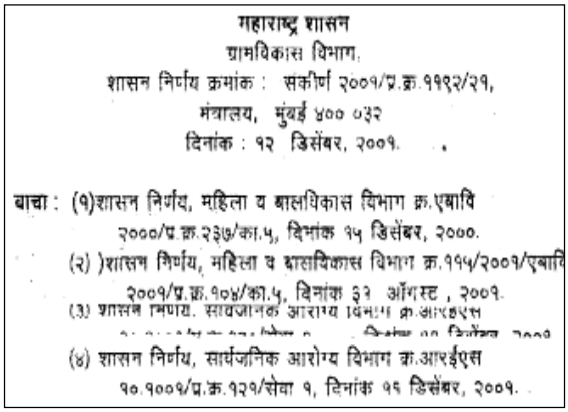
- Encourage the health and FW staff to report all child deaths
- Establish accountability at all levels.
- Involve community in recording child deaths.
- A review by an outside agency should be introduced. When this was done by the district magistrate in the Aheri block in Gadchiroli, the reporting by the Health and FW department dramatically improved.

'Social audit' of child mortality was found to be a powerful administrative and advocacy tool. The CDSAG study report resulted in a debate in the state, the Chief Minister accepted the recommendations leading to a Government Resolution to record child deaths with 100% completeness and a regular review by the District Magistrates.

Effect of an independent audit on the reporting of child deaths

(Aheri Taluka, Gadchiroli District)
Mortality rates : Before the review (1998) and after (2000)



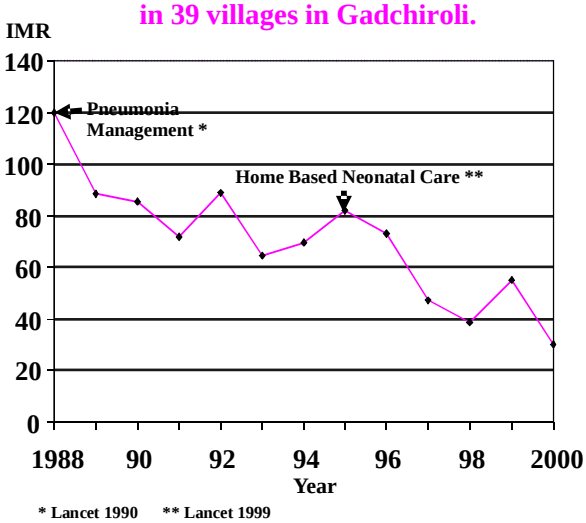

महाराष्ट्र शासन
ग्रामविकास विभाग,
शासन निर्णय क्रमांक : संकीर्ण २००१/प्र.क्र.११९२/२१,
मंत्रालय, मुंबई ४०० ०३२
दिनांक : १२ डिसेंबर, २००१.

वाचा : (१)शासन निर्णय, महिला व बालविकास विभाग क्र.एबाधि
२०००/प्र.क्र.२३७/का.५, दिनांक १५ डिसेंबर, २०००.
(२))शासन निर्णय, महिला व बालविकास विभाग क्र.११५/२००१/एबाधि
२००१/प्र.क्र.१०४/का.५, दिनांक ३१ ऑगस्ट , २००१.
(३) शासन निर्णय, सार्वजनिक आरोग्य विभाग क्र.आरईएस
(४) शासन निर्णय, सार्वजनिक आरोग्य विभाग क्र.आरईएस
१०.१००१/प्र.क्र.१२१/सेवा १, दिनांक १६ डिसेंबर, २००१.

B) To reduce the IMR.

The Home-based Neonatal Care model evolved in Gadchiroli offers a possible solution. In a backward rural area with a baseline IMR of 121 in 1988, community based care by trained village health workers was introduced in two phases, each resulting in decline in the IMR. The IMR reduced to 30 in the year 2000, which is exactly the goal of the National Health policy and the National Population Policy of India, to be achieved by the year 2010.

Effect of Intervention on the IMR in 39 villages in Gadchiroli.



* Lancet 1990 ** Lancet 1999

Introduction

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

i) The genesis of the study

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

1. Gadchiroli is the least developed district in Maharashtra. The Society for Education, Action and Research in Community Health (SEARCH), a non-government organisation, operates a vital statistics measurement system in nearly 100 villages in

the Gadchiroli district since 1988. This system regularly generates quality data on birth rate and child mortality in nearly 80,000 population and these data 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. On our pointing out at this discrepancy the district magistrate (collector) was asked by the state government to verify this (1998).

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:

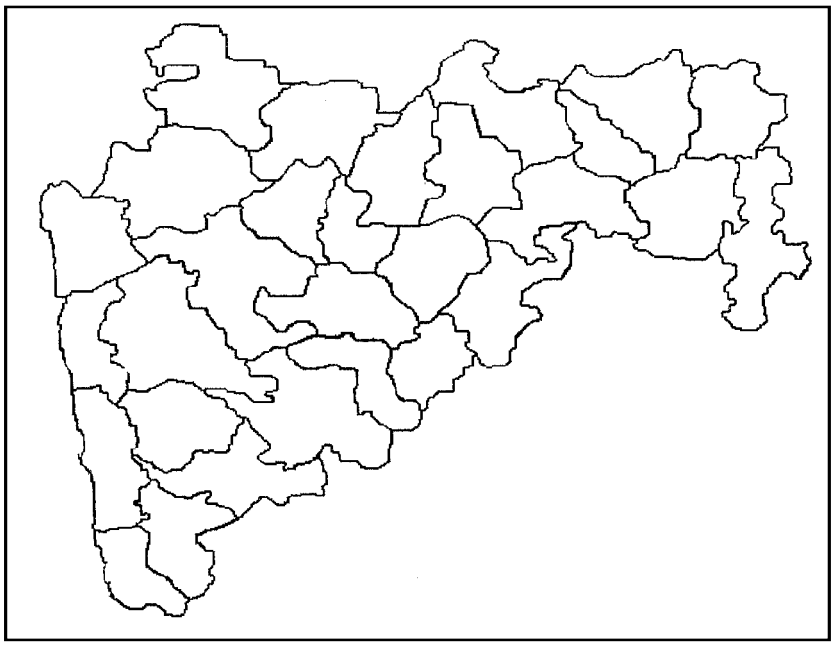
	Health and FW Department	District Magistrate
Still Birth Rate	4	68
Infant Mortality Rate	13	118
< 5 years Child Mortality Rate	20	168

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).

2. Though Maharashtra is an economically well-off state, the 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 (earlier a part of Dhule) districts (Figure 1). 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 measurers.

However, the issue of child mortality was looked at as an aberration limited to a few tribal pockets and was managed in an adhoc 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?

Figure 1 : Tribal pockets in Maharashtra with repeated media reports of large scale child deaths



3. It was disturbing that these episodes were always first reported by the news-papers. 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 the 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?

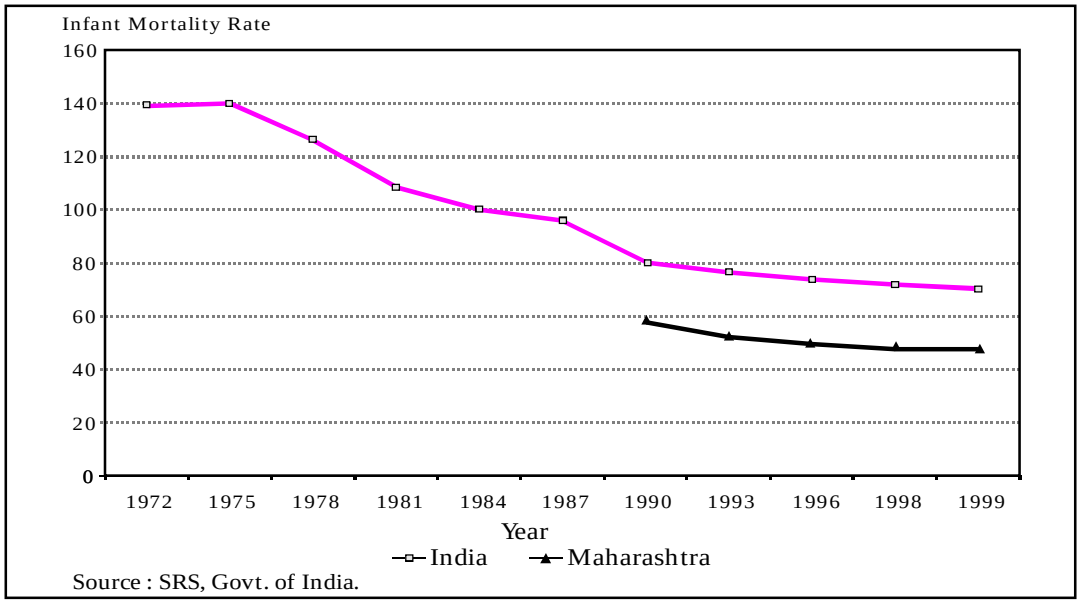
4. The goal of the National Health Policy (1983) and 'The Health for All' was to reduce the infant mortality rate to <60 per 1000 live births by the year 2000. The official statistics, that is, the MIS of the government of Maharashtra and the SRS of the government of India showed that the goal had been achieved (GoM 2000, GoI 2000).Was it true ? (Panel. 1)

Panel 1

Goal of the National Health Policy (1983): To reduce the Infant Mortality Rate (IMR) to below 60
IMR in Maharashtra as reported by Sample Registration System (SRS) in 1998 : 49.0 Management information system (MIS) of Government of Maharashtra : 13.9
What was the real IMR in Maharashtra?

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) (Figure 2)

Figure 2 : Stagnation of Infant Mortality Rate in India and Maharashtra



Source : SRS, Govt. of India.

This meant that the programs which addressed the problem of child mortality (reproductive and child health program, immunisation program, ICDS) were no longer effective in further reducing the IMR. A larger proportion of infant deaths were now contributed by neonatal deaths because this component is influenced little by the current programs (GoI 2000a). However, it is widely suspected that the real magnitude of the neonatal mortality is not appreciated due to gross under-recording of neonatal deaths as well as the still births (James et al 2000). Is it true ?

6. The National Population Policy (2000) has set the new goal to reduce the IMR to less than 30 by the year 2010 (GoI 2000b). Many states, including Maharashtra, have formulated a state population policy, with the state-specific goals to reduce the IMR. In the absence of reliable information, how will the states know their progress towards this goal ?

The grassroots 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 1990s, has led to the appointment of the National Statistical Commission. Its Chairman, Mr. C. Rangarajan, has succinctly summarized 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).

This is very disturbing. Is the very basis of our planning and decision making in health programs unreliable ? What are the current major sources of the information?

ii) Information on Births and Child deaths

1. **Sample Registration System (SRS)**, under the Registrar General of India, (Ministry of home affairs, Government of India) 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 494,939 and of 486,011 people respectively by the International Institute for Population Sciences, Mumbai (NFHS 2002), as the projects of the Ministry of Health and Family Welfare, Govt. of India, funded by the US-AID and the UNICEF.
3. **Civil Registration System (CRS**): Under the Civil Registration of Births and Deaths Act (1969), of Government of India, the local governance bodies (gram panchayat and municipality) record births and deaths in their areas.
4. **Management Information System (MIS**): of health and family welfare departments of the 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:

Panel 2 : Limitations of the SRS and the NFHS

I) These cover a very small proportion of population in each state as their sample. For example, the 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 primary health center. Moreover, since the sample size is not large, especially in the NFHS, the estimated rates have wide confidence intervals.

ii) The reports of the SRS become available usually after a lag of three years and the NFHS has been conducted once in seven years.

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

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

However, the health and FW department as a part of its regular work needs to record every pregnancy and every birth because these constitute the 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) of the Health & FW department, on a monthly basis, is as follows:

Multipurpose worker (auxiliary nurse midwife) at the health sub-centre

↓

Medical officer of primary health center

↓

District health officer

↓

Directorate of health services, state.

iii) Importance of the MIS data

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 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 children. Thus, what seems merely technical information for the internal consumption of the department, becomes the critical data on which the actualization 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 !*

On this background, we have prospectively measured child mortality in different areas in Maharashtra, estimated the extent and causes of underreporting 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 the corrective measures for complete recording of child deaths, and discussed a new approach to reduce the IMR in the state However, *we want to make it clear that, the findings and the inferences are more indicative than definite estimates.*

Aims of the Study

The study was planned to answer 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 ?

Methods

i) Selection of study population

a) Sampling

Ideally, a stratified cluster sample should be randomly selected from the total population of the state for measuring the 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 large number of clusters of population spread over the entire state, more so if the data collectors are outsiders and strangers. Thus, though these random sample 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 organizations 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 (Panel. 3).

Panel 3 : Eight population strata proposed for the study

Strata No	Type	Region of the State	Level of development
1	Rural	Eastern;	better developed area
2	Rural	Eastern;	less developed area
3	Rural	Western/Southern;	better developed area
4	Rural	Marathwada;	less developed area
5	Tribal	Eastern;	tribal pockets, least developed
6	Tribal	Western;	tribal pockets, least developed
7	Urban	Slums;	area with poor housing conditions
8*	Urban	Non-slums;	area with better housing conditions

*This stratum could not be included in the survey.

To estimate the IMR over a two year period we computed the minimum required population sample size in each stratum to be about 20,000 (x 2 years).
(Assumption: p of infant death=0.05, permissible degree of error 0.015, CBR = 21)

b) Recruitment

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 (Amrawati). Those who expressed serious interest in participating in the study were asked to complete the sequent steps.

A contiguous area of villages or communities, where the NGO had good contacts (sometimes 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

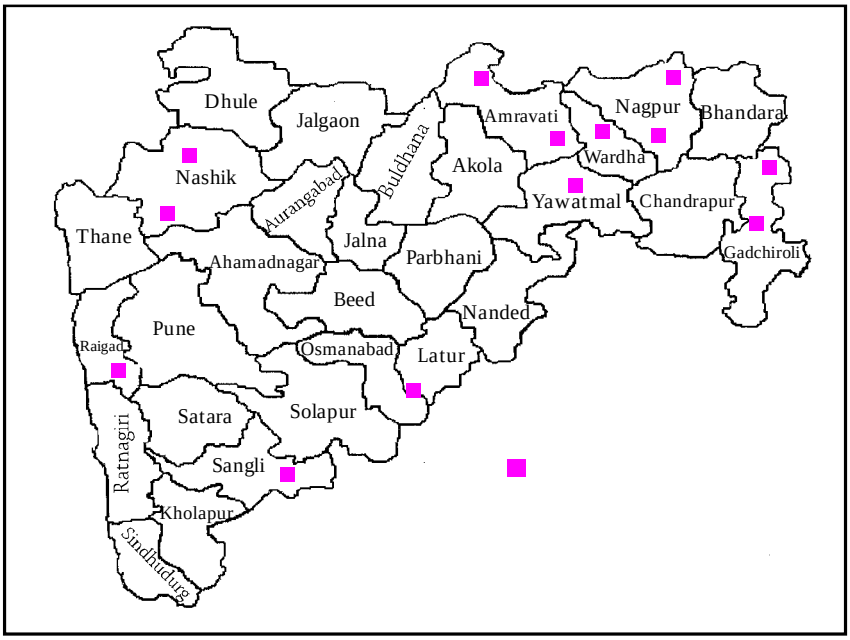
deliberately select successful program areas or severely affected or difficult villages. In the urban area, we sought two types. An area of slums or of poor housing conditions, an another area with better housing conditions. The people in the villages/slums were approached, the purpose and the nature 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 the data.

We selected 19 NGOs who completed the above steps and who provided required or larger study population in each of the stratum 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 generally characterised by 'k*achcha'* 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 (stratum 8).

The selected NGOs together constituted 'The Child Deaths Study and ActionGroup' (CDSAG), Maharashtra. This study, hereforth, will be called the CDSAG study.

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 3) and only these have been included in the analysis.

Figure 3 : CDSAG Study Sites in Maharashtra



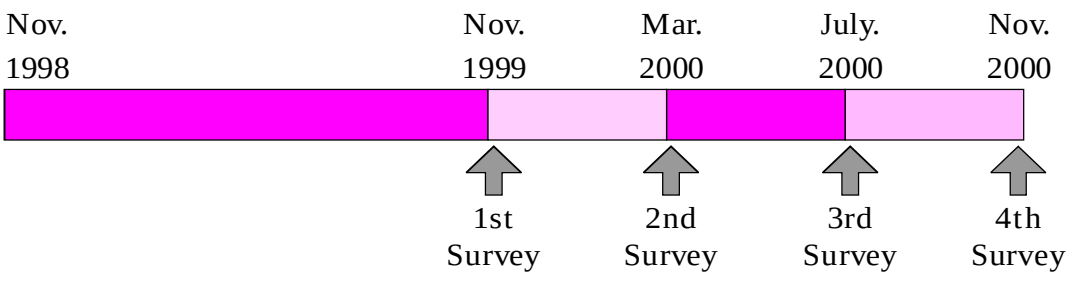
ii) Data Collection

The 13 study sites included 231 villages and 6 urban slum-like areas from 10 districts with a total population of 226,904. The data collection methods used in this study were based on the prototype used by SEARCH in the Gadchiroli district for the past 12 years with the proven ability to record 98% of the births and child deaths *(Bang et al 1990, 1999).* At 13 study sites, the data on births and child deaths in a period of two years (November1998 to October 2000) were gathered by a team of 200 community workers under the guidance of 26 supervisors. 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%. The supervisors, in turn, trained the village (community) workers in their project areas in the presence of the research team.

The list of families was based on the most recent voters list supplemented by the gram panchyat records. The first house to house survey was conducted in November 1999 to collect the information on births and deaths by retrospective inquiry for the period November 1998 to October 1999 (Figure 4).

Figure 4 : Timings and methods of data collection



Type of data collection		Period covered
1st	Survey (retrospective)	Nov. 1998 to Oct. 1999
2nd	Survey (retrospective) + Prospective recording	Nov. 1999 to Feb. 2000
3rd	Survey (retrospective) + Prospective recording	Mar. 2000 to Jun. 2000
4th	Survey (retrospective) + Prospective recording	July 2000 to Oct. 2000

In the first and the subsequent surveys, a list of pregnant women in the village was made, and all pregnancies were followed up to record the outcome which could be - abortion (<28 weeks), still birth or a live birth. Incentive money was paid to 'dais'(traditional birth attendants) and the community workers for the each recorded birth and child death, to encourage complete enumeration. These two measures substantially contributed in getting complete information on births and child deaths.

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

The next challenge was not to over-record the events. 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 written attestation of parents and village sarpanch were obtained. Only the births and the 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 parents' home for delivery is approximately equal to the number of the 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.

Information about village characteristics in the study areas was collected from the gram panchayats. The population enumeration and listing of women and children were done in each village by visiting all houses during the mid-point of the study period (December 1999).

The first survey recorded the information by retrospective inquiry about the births & deaths in the first year. Now, since the system had been established, the information was collected in the second year (November 1999 to October 2000) 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.

In the second year of data collection (1999-2000) the cause of death was determined 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 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 (panel. 4)

Panel. 4

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

Discussions were held at various levels in the Health and FW department, including the female MPWs (ANM) of sub-centers, 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.

Findings and Discussion

The findings and discussion are presented in four sections. In 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 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.

i) The population size and the characteristics

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, i.e. 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.

Table 1 : Study strata, sites and population

Type of strata	Sratum No.	District	NGO	Village/ slums	Population	Total strata population	% of sample population
(A) Rural - nontribal							
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)	Nashik	VACHAN	14	16,006		
		Sangli	RSP	13	26,710	42,716	18.8
Marathwada region							
Less developed	(4)	Latur/ Osmanabad	Sahyog Nirmiti	15	23,880	23,880	10.5
Total Rural						157,664	69.5
(B) Tribal							
Eastern region	(5)	Amrawati	Khoj	9	3,290		
		Amrawati	Melghat Mitra	12	4,533		
		Gadchiroli	AAA	30	10,223		
		Yawatmal	SRUJAN	15	9,801	27,847	12.3
Western region	(6)	Nashik	KP	13	16,208		
		Raigad	Jiwhala	22	4,857	21,065	9.3
Total Tribal						48,912	21.6
(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%

The total study population (226,904 x 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 (333,000 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 can not be placed on the precision of the rates at the individual site. A stratum will be more reliable unit.

The study population in seven strata was distributed among 13 clusters in 10 districts in different parts of the state. Yet, since it was not selected randomly, it wasnot completely representative of the state population. The non-tribal rural population (69.5%) was more than the proportion of non-tribal rural population in the state (48.3%). The tribal population (21.6%) also was more than the proportion of tribal population (9.3 %) in the state (GoI 2001). On the other hand, the urban population (9%) was lesser than the proportion in the state (42.4%); 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% urban population in Maharashtra lived in slums or in poor housing conditions (Gupta and Mitra 2002).

The study sample also had higher proportion from the eastern Maharashtra (Vidarbha) because:

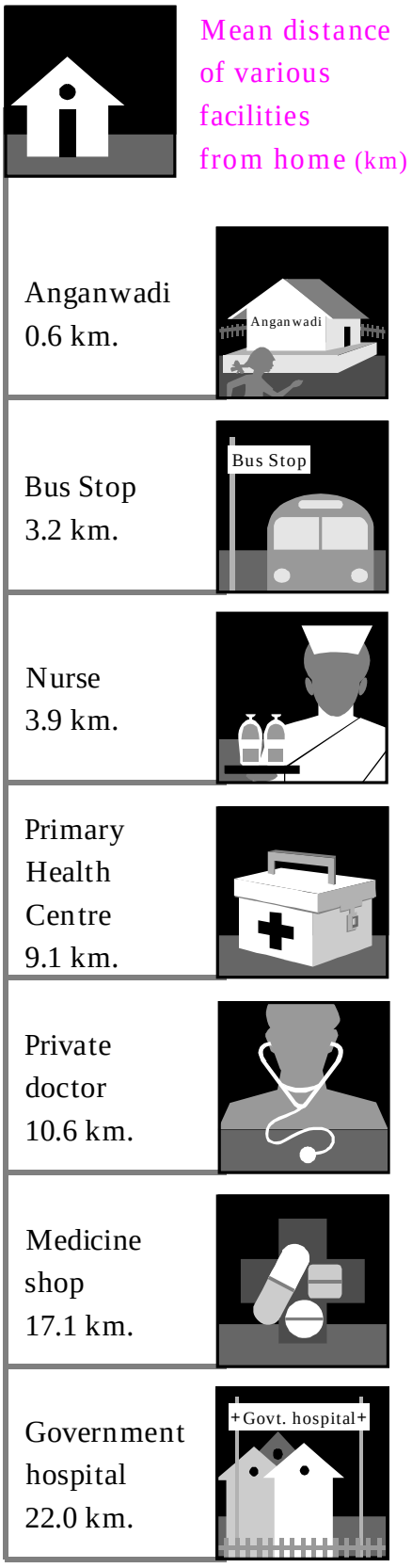
a) The only urban slum-like stratum was selected from this region

b) Four NGOs in the other regions either dropped out or could not complete data collection, thereby creating larger representation of the eastern region.

The problem of improportionate representation of rural, tribal and urban populations 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 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.

Availability of various services in the study population (excluding urban) was as follows (Figure 5):

Figure 5 : Mean distance of various facilities from home in the study villages.



***School*:** Ninty-two per cent villages had primary schools and 21.3% had secondary schools.

***ICDS*:** 89.8% villages had Aganwadis.

***Roads and Transport* :**

- 44.7% villages had all-weather tar road.
- 36 % villages had a bus stand.
- Another 19.6% and 31.5% were located within one and five km from the bus stand respectively,
- 12.9% villages did not have access to bus within 5 km.

***Health Services*:**

29.8% village had an ANM stationed in the village but in 10.2% villages the ANM was over 10 km away.

The mean distance of ANM from village was 3.9 km;

4.4% villages had a PHC stationed in them. Average distance of PHC from the village was 9.1 km;

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

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

The mean distance of the government hospital was 22 km;

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.

ii) Birth Rate and Still Birth Rate

Total 9,377 live births and 311 still births were recorded in the study population during two years (1998-2000). Overall crude birth rate was 20.7 per 1000 population and still birth rate was 32.1 per 1000 births. The place of delivery, crude birth rate and still birth rate at different sites are presented in Table 2.

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

NGO	District	Type of area	Population*	Total births	%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 Prakalp (RSP)	Sangli	Rural	53,420	864	31.7	828	15.5	36	41.7
Vachan	Nashik	Rural	32,012	981	90.6	959	30.0	22	22.4
Sahayog Nirmiti	Latur/ Osmanabad	Rural	47,760	958	69.6	928	19.4	30	31.3
	Total Rural		315,328	6,330	72.4	6,123	19.4	207	32.7
Khoj	Amarawati	Tribal	6,580	238	97.5	233	35.4	5	21.0
Melghat Mitra	Amarawati	Tribal	9,066	401	99.3	386	42.6	15	37.4
Amhi Amchaya Arogyasathi (AAA)	Gadchiroli	Tribal	20,446	649	98.8	629	30.8	20	30.8
Srujan	Yawatmal	Tribal	19,602	423	97.6	416	21.2	7	16.5
Kusumagraj Pratisthan (KP)	Nashik	Tribal	32,416	571	99.1	552	17.0	19	33.3
Jiwhala	Raigad	Tribal	9,714	284	94.4	276	28.4	8	28.2
	Total Tribal		97,824	2,566	98.1	2,492	25.5	74	28.8
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

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

iii) Crude birth rate

The overall crude birth rate (CBR) of 20.7, (95% CI, 20.2 to 21.1) was very similar to 21.1 (95% CI,20.6 to 21.6) reported for the state by the SRS (1999) and it varied from 25.5 in tribal areas to 19.4 in rural areas and 18.7 in slum-like areas. Relatively lower level of CBR suggests an effective family planning program in the state, and that the study population had good access to these services. High CBR in two study clusters in Amaravati district could be due to the small population size of these clusters and hence large confidence interval 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.

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	205250	19.2	
	0.1-5.0	115	175976	20.6	
	>5.0	29	28490	32.3	<0.01
Type of road to the village	Pucca	96	233243	19.0	
	Kutcha	129	176473	23.0	<0.01
Presence of ICDS# worker in the village	Same village	202	385681	20.6	
	Other village	23	24035	21.6	<0.33
Distance from high school (km)	Same village	48	154895	18.6	
	<=3.0	72	111840	19.8	
	3.1-5.0	38	51064	22.1	
	>5.0	67	91917	24.6	<0.01
Distance from health subcentre (km)	Same village	67	179303	19.6	
	0.1-5.0	107	157916	20.9	
	>5.0	51	72497	23.0	<0.01
Distance from Primary Health Centre (km)	<=5.0	74	162839	18.6	
	5.1-10.0	76	150931	21.7	
	>10.0	75	95946	22.6	<0.01
Distance from Private Doctor (km)	Same village	54	175728	18.3	
	<=5.0	70	97420	21.0	
	5.1-10.0	45	68594	23.3	
	>10.0	56	67974	23.9	<0.01
Distance from Government Hospital (km)	<=5.0	34	69543	17.5	
	5.1-15.0	70	110042	21.4	
	>15.0	121	230131	21.4	<0.01
Percent institutional deliveries	<=30.0	169	255323	22.9	
	30.1-60.0	34	85210	17.4	
	>60.0	22	69183	16.8	<0.01

* Village characteristics information about 6 villages was missing.
# ICDS : Integrated Child Development Scheme, Govt. of India.

The CBR varied significantly with most of the characteristics as expected, except for the not significant association with the presence of ICDS worker in village, probably because the family planning services reach villages even in her absence.

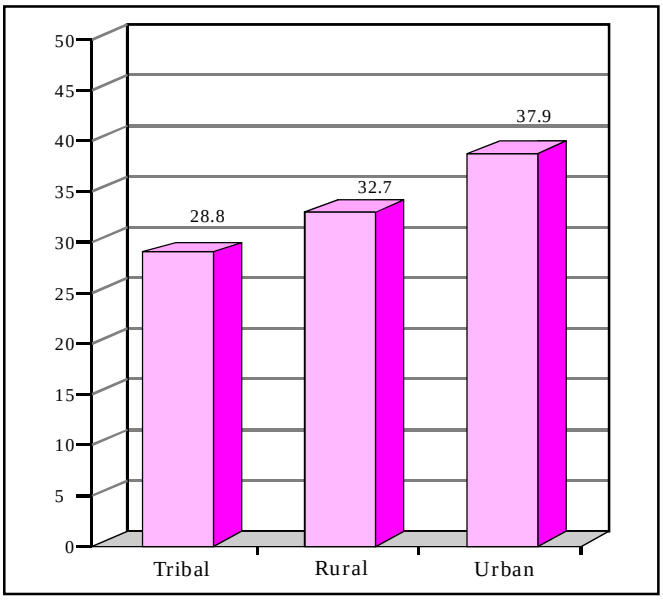
The CBR in the Sangli area was the lowest (15.5). This might be explained by the higher level of development in the district, but could be partly caused by the widespread use of prenatal sex determination and selective abortion of female foetus in this part of Maharashtra (GoI 2001) as further discussed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

iv) Still Birth Rate (SBR)

The overall SBR found in this study was 32.1 per 1000 births (95 CI, 28.6 to 35.6). (Table -2). This is much higher than the SBR of 11 reported for the state by the SRS (GoI 2000).

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 death 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 i.e sum of SBR and early NMR during 0-7 days**)** were also high (Table 4). The overall 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 (Table 2 and 4) and in the various regions in the State (Figure 6). Hence, the high SBR was a general feature.

Figure 6 : Still Birth Rate in different types of population in Maharashtra (CDSAG)



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 countercheck. Hence, both the informer and the interviewer may miss to record 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 followed in this study. The higher SBR, presumably due to more complete recording of still births, in this study can be explained by the facts that 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). The highest SBR was recorded in rural Gadchiroli where SEARCH has a high quality vital statistics surveillance system which probabely yielded more complete reporting.

The SBR was higher in the non-tribal rural areas (32.7) and urban slum-like areas (37.9) than in the tribal areas (28.8). Similar unexpected pattern was observed in the perinatal mortality rate as well. Inspite of our best efforts, some degree of recall loss in reporting the still births might have occurred in the tribal areas. The alternative explanation that the maternal health is better in the tribal areas leading to lower SBR does not seem plausible.

v) Child Mortality Rates

Total 777 child deaths were recorded during the two years. The 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 striking findings in the table are : Wide variations are obvious within each stratum. This may be partly due to small sample size of the individual study sites;

The IMR was >60 in 10 out of 13 study areas. The phenomenon was not restricted to tribal areas but was prevalent in the 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% of infant mortality, and 61.7% 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.

The PNMR and the 1 - 4 year mortality rate in urban slums were nearly 50% higher than in the rural areas.

vi) Neonatal Mortality Rate

The mean NMR was 51.2. It was greater than 40 in 10 out of total 13 study areas : 5/6 tribal areas, 4/6 rural areas and 1/1 urban slum-like area. (Table 4).

The observed high NMR can not be explained by still births misclassified as neonatal

Table 4 : Age specific child mortality rates (1998-2000)

Name of NGO (study sites)	District	Neonatal deaths	Naonatal Mortality Rate	Perinatal Mortality Rate	1-11 Month deaths	Post Neonatal Mortality Rate	Infant deaths	Infant Mortality Rate	1-4 year deaths	1-4 year Mortality Rate	< 5 yrs Child deaths	<5 Child Mortality Rate
NIWCYD Chetna	Nagpur	34	48.7	60.4	12	17.2	46	65.9	3	4.3	49	70.2
Vikas	Wardha	45	59.3	59.9	9	11.9	54	71.1	6	7.9	60	79.1
SEARCH	Gadchiroli	128	65.6	90.9	28	14.4	156	80.0	23	11.8	179	91.7
R S P	Sangli	28	33.8	63.7	5	6.0	33	39.9	5	6.0	38	45.9
Vachan Sahayog	Nashik	38	39.6	45.9	14	14.6	52	54.2	10	10.4	62	64.7
Nirmiti	Latur/ Osmanabad	40	43.1	65.8	12	12.9	52	56.0	15	16.2	67	72.2
	Total Rural	**313**	**51.1**	**69.2**	**80**	**13.1**	**393**	**64.2**	**62**	**10.1**	**455**	**74.3**
Khoj Melghat	Amrawati	11	47.2	42.0	7	30.0	18	77.3	4	17.2	22	94.4
Mitra	Amrawati	20	51.8	67.3	15	38.9	35	90.7	14	36.3	49	126.9
A A A	Gadchiroli	44	70.0	81.7	13	20.7	57	90.6	9	14.3	66	104.9
Srujan	Yavatmal	21	50.5	44.9	7	16.8	28	67.3	10	24.0	38	91.3
K P	Nashik	20	36.2	56.0	19	34.4	39	70.7	12	21.7	51	92.4
Jiwhala	Raigad	15	54.3	66.9	7	25.4	22	79.7	8	29.0	30	108.7
	Total Tribal	**131**	**52.6**	**62.4**	**68**	**27.3**	**199**	**79.9**	**57**	**22.9**	**256**	**102.7**
ISSUE	Nagpur	36	47.2	73.2	16	21.0	52	68.2	14	18.4	66	86.6
	Toral Urban	**36**	**47.2**	**73.2**	**16**	**21.0**	**52**	**68.2**	**14**	**18.4**	**66**	**86.6**
	Total	**480**	**51.2**	**67.7**	**164**	**17.5**	**644**	**68.7**	**133**	**14.2**	**777**	**82.9**

deaths because the SBR and Perinatal Mortality Rate were also high. Moreover, the high NMR (>40) was not localized, but was observed in 10/13 study areas.

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

vii) Infant Mortality Rate :

The mean IMR was 68.7. The national goal of reducing the IMR to < 60 by the year 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 can not explain the observed high IMR because it was high separately in all 3 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 from the bus stand or backwardness of the eastern region of the state or the percent population living below poverty line.

B) Estimating the Corrected Infant Mortality Rate and Child Mortality

Due to the limitation of not being a random sample survey, this study is not the ideal basis to make the 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 the number of 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 compared with the reported rates in the SRS and NFHS II in Table 5 and Figure 7. 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 study 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 as compared to 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 CDSAG study was nearly 20 points greater than reported in the SRS and NFHS II. This was the most important difference. This phenomenon was observed in the rural as well as in the urban stratum (The 'rural' stratum 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 study. This difference can be explained by two factors. The main difference was caused by the higher NMR recorded in the CDSAG study. This presumably was due to better quality of data collection in CDSAG. However, the selection bias in the study population in the CDSAG study also might have contributed to this estimated higher IMR.

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

Table 5 : Comparison of child mortality rates in Maharashtra reported in different surveys.

Type of Area	NMR			IMR			NMR % of IMR			PNMR (1 month-1year)			1-4 Year Mortality Rate			1-4 Year mortality compared to IMR			<5 Year Mortality Rate		
	CDSAG[1]	NFHS[2]	SRS[3]	CDSAG[1]	NFHS[2]	SRS[3]	CDSAG[1]	NFHS[2]	SRS[3]	CDSAG[1]	NFHS[2]	SRS[3]	CDSAG[1]	NFHS[2]	SRS[3]	CDSAG[1]	NFHS[2]	SRS[3]	CDSAG[1]	NFHS[2]	SRS[3]
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	0.20	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: Nontribal	51.1	-	-	64.2	-	-	79.6	-	-	13.1	-	-	10.1	-	-	0.16	-	-	74.3	-	-
Rural: Tribal	52.6	-	-	79.9	-	-	65.8	-	-	27.3	-	-	22.9	-	-	0.29	-	-	102.7	-	-

1 : Child Death Study and Action Group, Maharashtra : 1998-2000 (this study)

2 : NFHS-II : National Family Health Survey (1998-99)

♣ : Rural includes nontribal as well as tribal areas

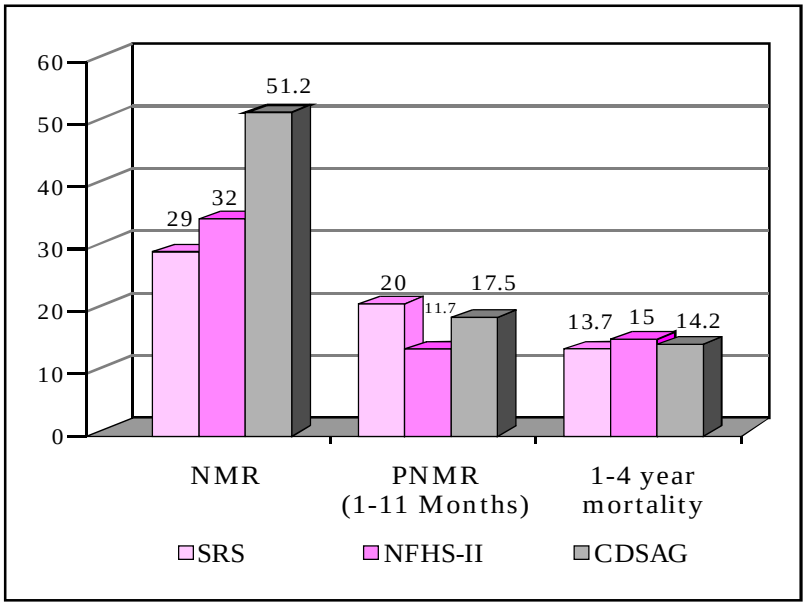
3 : SRS : Sample Registration System, Register General of India (1998)

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% confidence interval based on the NFHS II data were 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 the neonatal deaths. The use of outside investigator, 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 study 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.

i) Neonatal Mortality Rate and the IMR

The NMR observed in the rural (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% as against 60.3% reported in the SRS (GoI 2000). This needs further scrutiny.

Figure 7 : Child Mortality Rates in different surveys



This difference can not 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% vs 75%). 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 percent share by NMR in the SRS.

Our finding that the NMR contributed nearly 75% of the IMR in Maharashtra is well supported. The NFHS II reported that the NMR contributed 73% of the IMR in

Maharashtra (Table 5). Similarly, the NMR contributed 70-76% of the IMR in the states with moderately reduced IMR such as Andhra Pradesh, Karnataka and Tamilnadu during 1995-97 (SRS) (James et al 2000). Tamil Nadu, with higher proportion (76.3%) of hospital deliveries (IIPS 2000) is a state where likelihood of missing neonatal deaths is less. SRS reported the NMR to be 74% of the IMR in Tamil Nadu in 1996. Goa has the best Civil Registration System (CRS) with 92% complete reporting of infant deaths. During the four year period (1995-98), the mean NMR as percent of IMR was 81.5% in Goa and 78.8% in Kerla (CRS 2002). The vital statistics collected in the 47 villages in the control area of SEARCH also reported an NMR of 58.6 constituting 75% of the IMR during 1995-1998 (Bang et al 1999).

Thus, 75% share of the IMR in Maharashtra being contributed by the NMR as 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%, from 139 in 1972 to 72 in 1996 (SRS). However, during the same period, the post-neonatal component declined more (63.3%) than the NMR which declined only by 34% 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% in 1971-73 to 70% 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 i.e 60.3% of the reported IMR of 49.0. All other evidence cited earlier, including the SRS reports of 1995-97, suggest that the NMR should constitute at least 70% to 75% 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 are the 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 the 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 made in last 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, can not be known. *Comparision with the CDSAG study findings provides a preliminary quantification of the underreporting.* We have already discussed the probable

explanations of more complete recording of 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 recognize this fact because the government of India has become alarmed by the stagnation of IMR in India at the level of 70-75 for last five years (1993-98). The main reason is that the 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 area in Maharashtra (Sangli) where it was 33 which is similar to the NMR reported by the SRS or NFHS II for the whole of Maharashtra (29 and 32 respectively) suggesting these to be unrealistic. We found that the NMR in all other 12 study areas was higher. Even in the urban slum-like area, with a large proportion (55%) of hospital deliveries, the NMR 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 the 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%) proportion of IMR contributed by the NMR, in the SRS (1998)

ii) 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 the SBR recorded in this study. The SBR of 37.9 recorded in this study in urban slum-like areas where 55.2% deliveries occurred in hospitals and the SBR of 41.7 in Sangli where 68.3% deliveries occurred in hospital are the evidence that relatively high SBR can exist inspite 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.

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

i) The National Neonatology Forum of India has collected data from 16 urban centers 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 the Gadchiroli, in a published field trial, recorded an SBR of 40.8 during the three year period of 1995-98 (Bang et al 1999).

iii) Matlab area in Bangladesh has a very wellknown 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 et al 1990).

iv) The recent report ,'State of India's Newborns' provides a table of 12 community-based studies in India. Most of them report the SBR in the range of 25 to 40 and the lowest estimate was 24.2 (Save the Children, 2004)

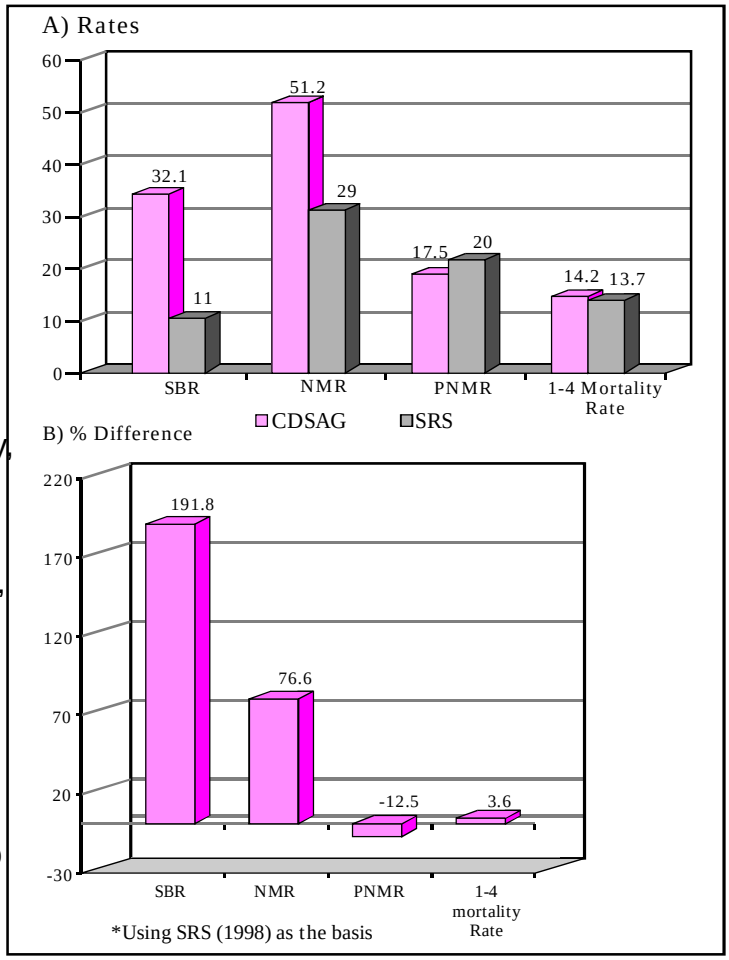
v) Interestingly, the SBR in the United States in 1940 was reported to be 29.5 when the NMR was 29.0. At that level of NMR, the SBR was almost equal. Even in 13 states in the US which followed the same definition of still birth (>28 weeks of gestation) as in this study, the SBR was 28.5 and the NMR was 26.9 (American Journal of Public Health 1994). As the NMR of 29, reported for Maharashtra by the SRS in 1998, is very similar to that recorded in the US in 1940, one would expect an SBR of similar order.

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

iii) The gradient of Completeness

The completeness of reporting in the SRS, in comparison with our study, improved as the age at death increased (Figure 8). The difference was maximum (191.8%) for still births, and minimum (3.6%) 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 year) are difficult to forget or hide.

Figure 8 : Age specific mortality rates in CDSAG and SRS*



iv) Estimating the corrected IMR by three methods

By making use of the insights so obtained, we have attempted estimating the corrected IMR by different methods, using the data from the CDSAG study and the SRS.

1) 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 stratum specific CBR as reported in the SRS, to estimate the number of live births in each stratum; and (c) applying to these births the stratum specific IMR found in the CDSAG study. (Table 5).

The first difficulty encountered was the lack of exact estimates of urban population living in the slums and in poor housing and environmental conditions. The proportion of slum population in urban Maharashtra has been reported to be 32% (GoI 2001). However, a sizable 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 1 room for the family) in Maharashtra is nearly 65% (Gupta and Mitra 2002). We have arbitrarily assumed the proportion of urban population living in 'slums and poor housing conditions' (SPHC) to be 50%, nearly the midpoint of these two estimates of 32% and 65%.

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% 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 off 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 of population (which is close to the IMR of 76, estimated by the NFHS-II for the Indian urban population with low standard of living (NFHS-II 2002).) 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 total urban population (Gupta and Mitra 2002). With 50% population of each type, the IMR for the population living in better conditions is thus indirectly estimated to be 25% 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 61.0 (95% CI, 56.2 to 65.8) (Table 6).

Table 6 : Weighted estimation of CBR, SBR and IMR in Maharashtra (CDSAG study)

Type of population	Population in 2001 (1)	CBR (2)	Annul live births (1x2)/1000 (3)	Annual total births # (4)	SBR (5)	Annual still births (4x5)/100 (6)	IMR (7)	Annual infant deaths (3x7)/1000
Tribal	8,968,933(a)	25.5*	228,708	236,255	28.8*	6,804	79.9*	18,274
Rural (non-tribal)	46,763,580(b)	23.6ʘ	1,103,621	1,140,040	32.7*	37,279	64.2*	70,853
Urban Slums and poor housing conditions (50 % of population)	20,509,867$	28.3☼	580,429	599,583	37.9*	22,724	68.2*	39,585
Urban Better housing conditions (50 % population)	20,509,867$	13.3☼	272,781	281,783	9.5**	2,677	17.0	4,637
Total	96,752,247(c)	22.6†	2,185,539++	2,257,661++	30.8†	69,484	61.0†	133,349

(a) : Scheduled tribes population in Maharashtra (1991 Census)
(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 % 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)
ʘ : 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.

2) By correcting the 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.

Inspite 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 probabely 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 (PNMR and 1-4 year mortality rate) in the SRS to estimate the corrected IMR.

2. a) Based on the PNMR in the SRS :

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

The PNMR in Maharashtra, as reported by the SRS in 1998, shows a sudden increase from the 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, 97, 98) in Maharashtra 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%. Moreover, the NMR reported in the NFHS II in Maharashtra was 73% of the IMR, and in the CDSAG study it was 75%.

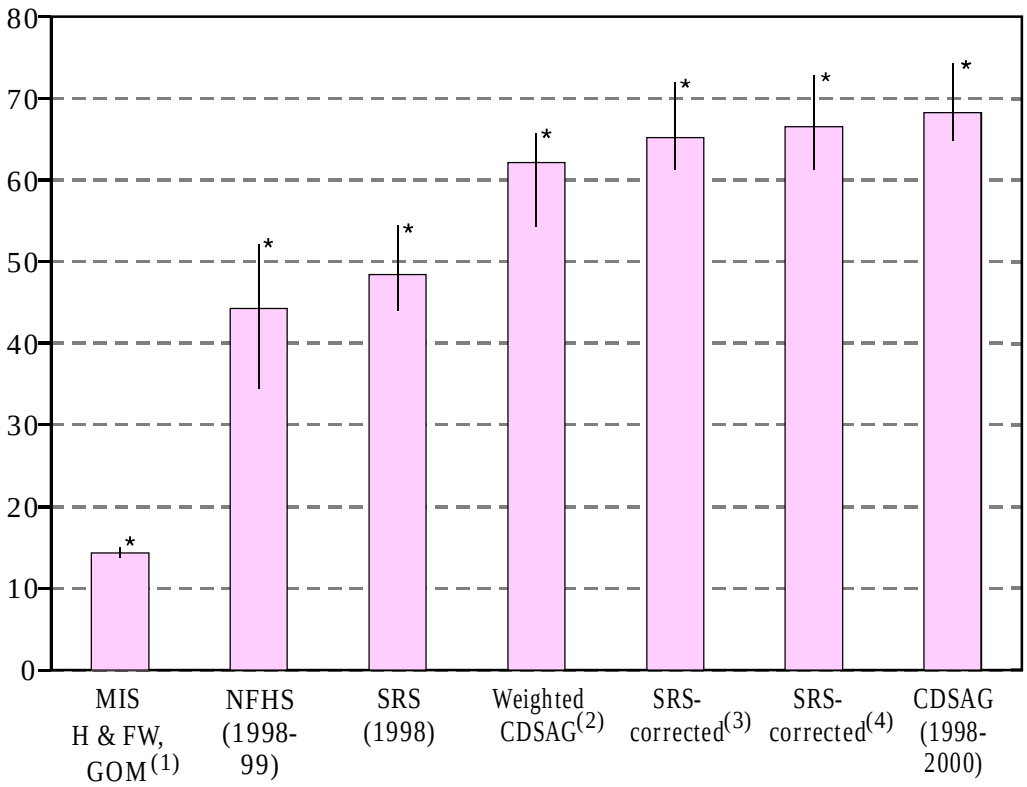
By using the three years average PNMR of 16.7 in the SRS and the proportion of the NMR at 75%, the estimated corrected IMR for Maharashtra is 66.8 (95% CI, 61.1 to 72.5).

2.b) Based on the ratio of IMR to the 1-4 years CMR in the 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 7), it is even more robust than the PNMR. The ratio of 1-4 year mortality rate to IMR in the CDSAG study was 0.207 (Table 5). Using this ratio, and the 1-4mortality rate (13.7) as reported in the SRS, the corrected IMR is estimated to be (13.7/0.207) = 66.2 (95% 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 underreported 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 9. Their 95% confidence intervals are also shown at the top of each bar.

Figure 9 : The Estimated Infant Mortality Rate in Maharashtra from different sources



(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) : Estimated based on the 1-4 year CMR in SRS 1998, and its ratio to IMR as found in CDSAG.
(4) : Estimated based on the 3-year (1996-1998) average PNMR in SRS and the proportion of PNMR to IMR at 25 %

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

Source of information	IMR (1)	1-4 years CMR (2)	<5years CMR/1000LB (1+2)	Estimated total child deaths (95 % CI) @	Estimated total still births (95 %CI)
1) NFSH 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 years mean PNMR in SRS(1996,97,98) and PNMR as 25% 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)	61.0	14.2	75.2	163,705@@ (153,256 - 174,154)	69,484 (61,616 - 76,908) #

* : 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 IMR and the live births in Maharashtra both estimated by the weighted CDSAG (table-6)
$: Total births estimated by using ratio of total births to live births in SRS as 1.011: 1
: Total births estimated by using ratio of total births to live births in in CDSAG as 1.033:1

Of these, we consider 66.2 as the most robust estimate because it is based on the SRS sample (the most representative), 1-4 years mortality rate (almost identical in all 3 surveys), and the ratio of 1-4 years mortality rate with IMR, as found in the CDSAG study (presumably with more complete recording).

v) Estimated child deaths in maharashtra

Using these 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.

vi) Estimated annual still births

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

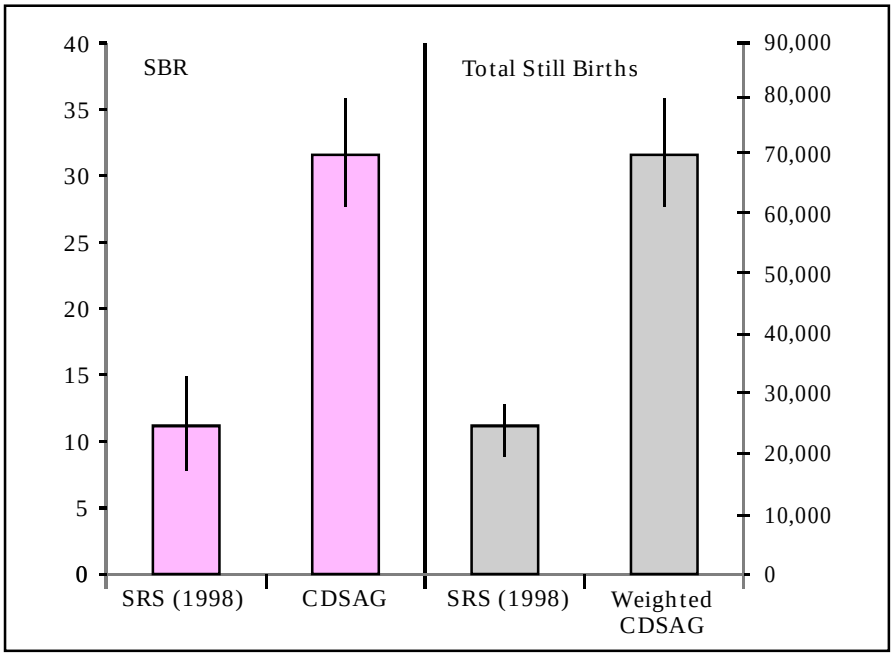
1) Based on the SRS (SBR: 11) = 24,210 (CI, 19,148 to 29,272)

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

3) Based on weighted CDSAG (SBR 30.8)= 69,484 (CI, 61,616 to 76,908).

Of these the last one is the most reliable estimate.

Figure 10 : Still Birth Rate and estimated total Still Births in Maharashtra.



Thus, we have different estimates of still births, IMR and total child deaths in Maharashtra (Fig 9,10 Table 7). We have already discussed the possible explanations of the differences.

Thus we finally estimate that during 1998-2000,

1. The Infant Mortality Rate in Maharashtra most probably was 66.2 (95% CI, 61.2 to 71.2).
2. Annual number of <5 years child deaths in Maharashtra most probably were 175,025 (95% CI, 164,140 to 185,909)
3. Total annual number of still births were 69,484 (95% CI, 61,616 to 76,908).

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%) sample population. The Health & FW department of the state needs to identify and record each pregnant woman, delivery, live birth and sick child at the 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 - sub centre, primary health centre, district, division and the state. The administrator can not effectively manage health services without such performance data. The SRS or NFHS or 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 the statewide operations, and are often conveniently cited to the non-technical persons such as the bureaucrats, politicians or the media (who often can not distinguish between the rates based on the MIS and the 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 & FW department, compared with the expected number of infant deaths (based on the rates reported by the SRS/Survey of Cause of Death (SCD) in the state) are presented in Table-8.

The table reveals that:

- Overall, only 30% of the expected infant deaths were reported in the MIS.
- For some districts, the reporting was extremely low, for example, Thane 3%, Nasik 5%, Solapur 7%, Nanded 9%
- Paradoxically, the reporting appears more complete in some districts, such as Gadchiroli, Amaravati, Yawatmal, Bhandara, Nagpur (rural), with a large proportion of tribal population. (This is unlikely due to better reporting and more likely due to using the average IMR for the state to estimate the expected number of infant deaths in each district, including in these districts with tribal population, resulting in the apparently more

complete reporting. However, why similar phenomenon did not occur in Thane and Nashik can not be explained.)

Districts such as Satara, Sangli, Jalgaon have a 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 the 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 (49) reported by the SRS for the whole state, when actually the IMR (SRS) for the 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%

If we use the corrected IMR of 66.2, as estimated in this study (section B), the completeness of the infant deaths reporting in the MIS was (13.9/66.2) = 21.0%

Thus, the infant deaths reporting in the MIS was only 21 to 24 percent complete.

3. Why are the child deaths under-reported ?

The reasons which came out in the discussion with the staff of the Health and FW department at various levels are :

Table 8 : Incompleteness of reporting of infant deaths in the MIS of Health & FW department of Maharashtra.

District	Expected number of infant deaths (based on SRS and SCD estimates)	Reported deaths in the MIS of Health Dept.	% Completeness of reporting in the MIS of the Health Dept.
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 (1998-2000) of the additional director, Division of Vital Statistics, Health and Family Welfare, Government of Maharashtra, Pune - 411001.)

1. Failure of the field worker (ANM) to reach every village and every house in her area of 5000-8000 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 majority of the deliveries are not involved in reporting. There is an incentive scheme to pay the dais Rs 5 to 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 and FW 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 (SCD). 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 as far as the reporting of child mortality is concerned.
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 to 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

1. Medical causes of death:

The medical causes of death were assigned only in the second year of the study (1999-2000), and are presented in Table 9.

Table 9 : Cause of death in children and cause specific mortality rates in the second year of the study (1990-2000)

(Population = 226,904 Live Births = 4714 Child deaths = 385)

Cause	Deaths			Cause specific mortality rate/1000 live births †
	No.	% of all deaths	% 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

* : 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 appears low, in this column.

† : Since more than one cause was assigned to many deaths, the total is more than 100 per cent or total CMR.

The major findings in the table are:

A. Neonatal mortality constituted the largest single 'cause' of death accounting for 58.7% of <5 child deaths.

B. In the post-neonatal age group, that is 1 month to 5 years,
   - Infections (pneumonia and diarrhea together) contributed 56.6% of deaths;
   - Malnutrition, which was obvious to mother was present in 25% of deaths only (this excludes low birth weight in neonatal deaths);
   - Immunisable diseases caused only 4.4% 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 immunization programme in Maharashtra.

A large proportion (56.6%) of deaths in 1-59 months age group occurring due to diarrhea and pneumonia inspite of the introduction of the oral rehydration therapy (ORS) 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 past rates, these suggest a large scope for improvement.

2. Neonatal Mortality

Neonatal deaths contributed 75% of the IMR and 62% of the <5 years mortality in the two years of 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 the '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 causes of deaths are not certified. The 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 the 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 of the neonatal deaths. Low birth weight was not included in the primary causes of death. However, its incidence in the study population was 42% and it was present in 90% of neonatal deaths (Bang et al 1999, Bang et al 2001).

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

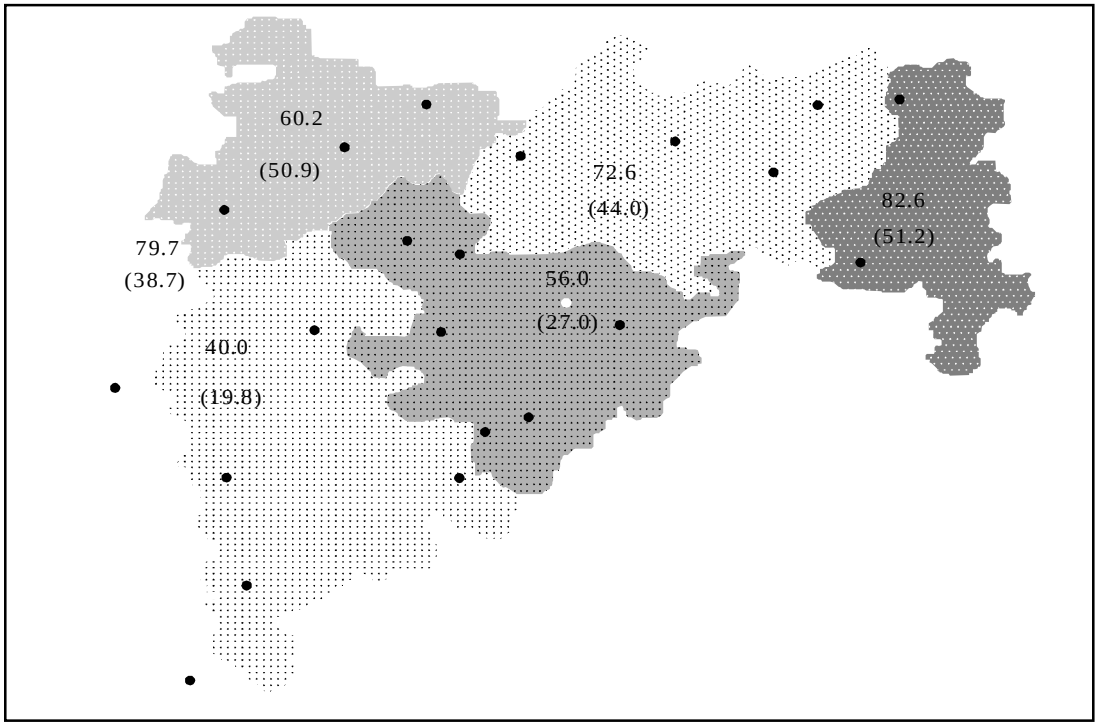
i) Neonatal deaths
ii) Infections - pneumonia, diarrhea and neonatal sepsis, and
iii) Malnutrition.

3. The Socio-economic causes

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

Figure 11 : IMR in different zones of rural Maharashtra (CDSAG 1998-2000) and poverty

(Percent rural families below poverty line: 1997-98, Govt. of Maharashtra)



A) The IMR recorded in the Six zones in Maharashtra is shown in Figure 11. The level of IMR broadly follows the percent of families below poverty line (GoM 2002).

b) The comparison of IMR in the least developed eastern region (9 districts of Vidarbha) (GoM 1984) with rest of the Maharashtra is presented in Table 10. The IMR in each stratum was higher in the Vidarbha than in other regions of the state.

Table 10 : Infant mortality rate in eastern region (Vidharbha) Vs rest of Maharashtra

Type	Eastern	Other regions	% Excess mortality in eastern region	p
Rural				
Developed	68.6	47.6	44.1	<0.013
Less developed	80.0	56.0	42.9	<0.026
Tribal	82.9	73.7	12.5	n.s
Urban	68.2	NA	-	-
Total	76.4	55.9	36.7	<0.0002

NA = Not Available.

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

c) 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.

Table 11 : Association of distance of village from the bus-stand with various child mortality rates

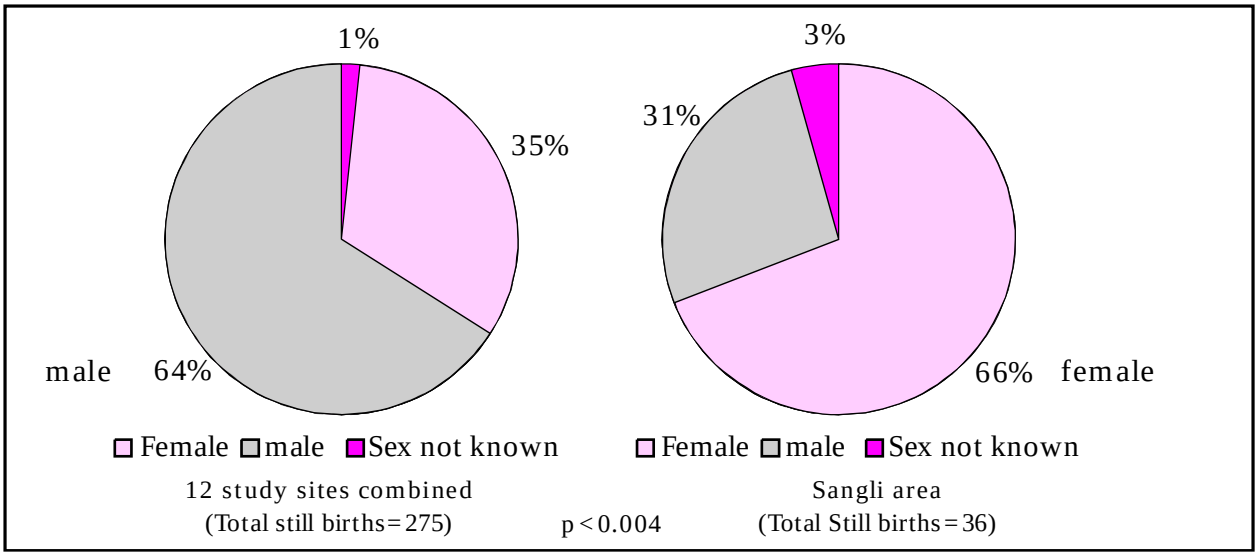
Distance of villages from bus stand (km)	Live births	NMR	PNMR	IMR	1-4 year Mortality Rate	<5year Mortality Rate
Same village	3936	48.3	9.9	58.2	11.9	70.1
0.1 - 5.0	3626	51.0	20.1	71.1	12.1	83.2
>5.0	919	71.8	32.6	104.5	27.2	131.7
Total	8481	52.0	16.7	68.8	13.7	82.4
p		<0.02	<0.001	<0.001	<0.01	<0.001

4. Reversed sex ratio

High SBR (41.7) in the study population in Sangli (one of the most prosperous rural districts) where 68.3% of deliveries occurred in hospitals was unexpected (Table 2).

Moreover, 66% of the reported 36 still births in Sangli area were female as compared with 35% in other 12 study areas combined ($p < 0.005$). (Figure 12) This suggests a

Figure 12 : Comparison of sex of still-born babies in Sangli with other 12 study sites.



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 India with low sex ratio in children 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 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 thousand births, and it was entirely female!

The evidence very strongly suggests a practice of female infanticide at birth. It is possible that those who can not afford the high medical cost of selective female fetus abortion achieve the goal at much lower cost by resorting to this practice at home.

Panel : 5

Case study of a couple planning for female infanticide.

A couple in a village in Sangli had two daughters. When the wife conceived for the third time, the couple wanted to go to the town for ultrasonography. However, they couldn't afford to pay for the services of the sonologist or obstetrician. Hence, they continued the pregnancy, anxiously.

On completing nine months of pregnancy, a female baby was delivered at home. The Dai was requested to kill the girl at birth, but she refused. The couple decided to kill the baby; but couldn't decide among themselves as to who should do the job. The husband insisted that since the wife had given birth to a girl she should complete the work. The wife argued that a mother was not expected to do such work; it was a duty of the man. The baby could not be killed on the first day.

For seven days the husband and wife quarreled to induce each other to kill the baby, but failed to do that. By now, the mother had started feeling an attachment to the baby. On the seventh day, unable to suffer the cruel pressure, the mother ran away with the baby to her parent's home. The baby girl is still alive.

E) Summary of the findings

This multi-site, population based study in Maharashtra found that in 1998-2000

1. The mortality rates in the population observed at 13 sites were:
   Still Birth Rate = 32.1 per thousand births (95% CI, 28.6 to 35.6)
   Neonatal Mortality Rate = 51.2 per thousand live births (95% CI, 46.7 to 55.7)
   Infant Mortality Rate = 68.7 per thousand live births (95% CI, 63.6 to 73.8)
   < 5 Child Mortality Rate = 82.9 per thousand live births (95% 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% CI, 61.2 to 71.2), i.e. nearly 17 points greater than the IMR estimated by the SRS.

4. We estimate that the annual number of deaths in Maharashtra to be:
   Still births (foetal deaths) = 69,484 (95% CI, 61,616 to 76,908)
   <5 years child deaths, estimated by correcting the SRS reported rate = 175,025 (95% CI,164,140 to 185,909).

5. The MIS of the Health and FW department recorded and reported an IMR of 13.9 with 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% 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 re-look at the current estimates.

F) Need for Further Research

- 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 in to 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 measured elsewhere and the causes of deaths, inspite of the accessible hospitals, in urban area identified.

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

In Search of Solutions

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

1. Need to completely record neonatal deaths and still births.

The SRS and the NFHS estimates are widely used for policymaking and planning. If the indications of this study are valid, then the SRS and NFHS both need to improve the 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 Birth and Deaths Act puts the onus of registering an event of birth or death in rural area on the family. However, in a predominantly illiterate population, the family members fail to do so, especially because they have nothing to gain and lot of time to loose in registering the birth or death with Gram Sevak who is the registering officer at village level but who erratically visits the village on few days in a month. Therefore child death registration in the CRS in Maharashtra is only 29% complete (CRS 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.

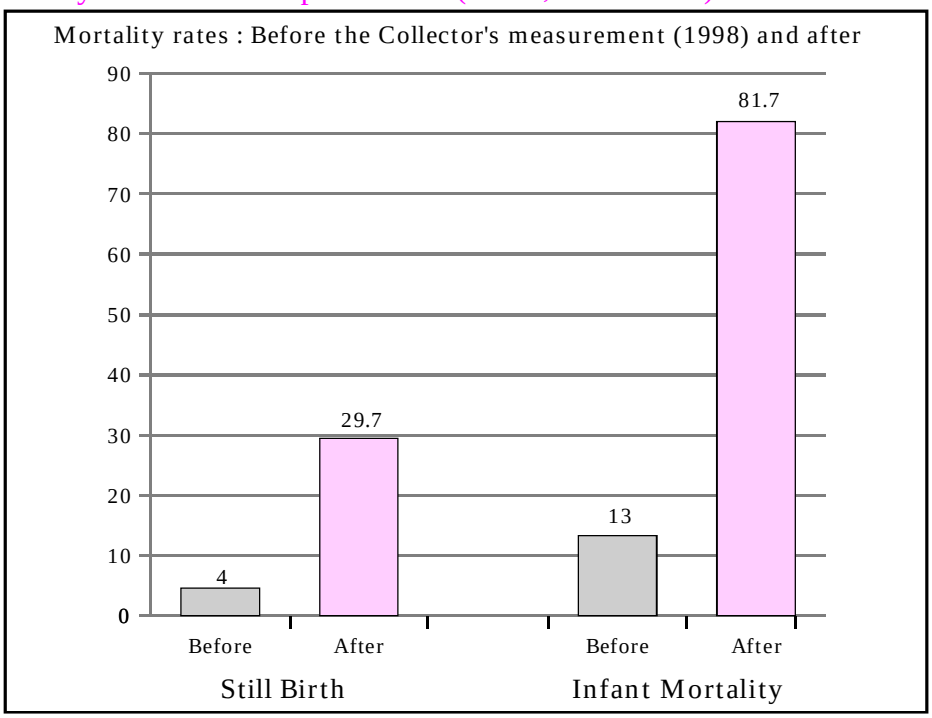
2. Corrective measures for the complete reporting of child deaths in MIS.

We have already discussed why, inspite of the sample estimates such as the SRS or NFHS, it is vital for the effective management of the Health & FW department to record the births and child deaths in the MIS and the reasons of under-reporting.

- A goal of 100% 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 the ICDS workers and Gram Sabha (village council) 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 primary health centre, the gaps or lapses identified and corrective actions initiated. The Methods such as path analysis and social autopsy can be used for this purpose.
- 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 the 'child death audit' can have 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 previous five years was extremely low - only 13. Though the collector was transferred, the impact of such independent measurement and review on the IMR subsequently reported in the MIS of the health department from the same Aheri block is shown in the Figure 13.

Figure 13 : Effect of an independent audit on reporting by the health department. (Aheri, Gadchiroli)



- The MIS data should be actively scrutinized 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 last section, we describe the case study of the effect of 'social audit' as a method of introducing administrative reforms.

3. A new strategy to reduce the IMR

There is an 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.

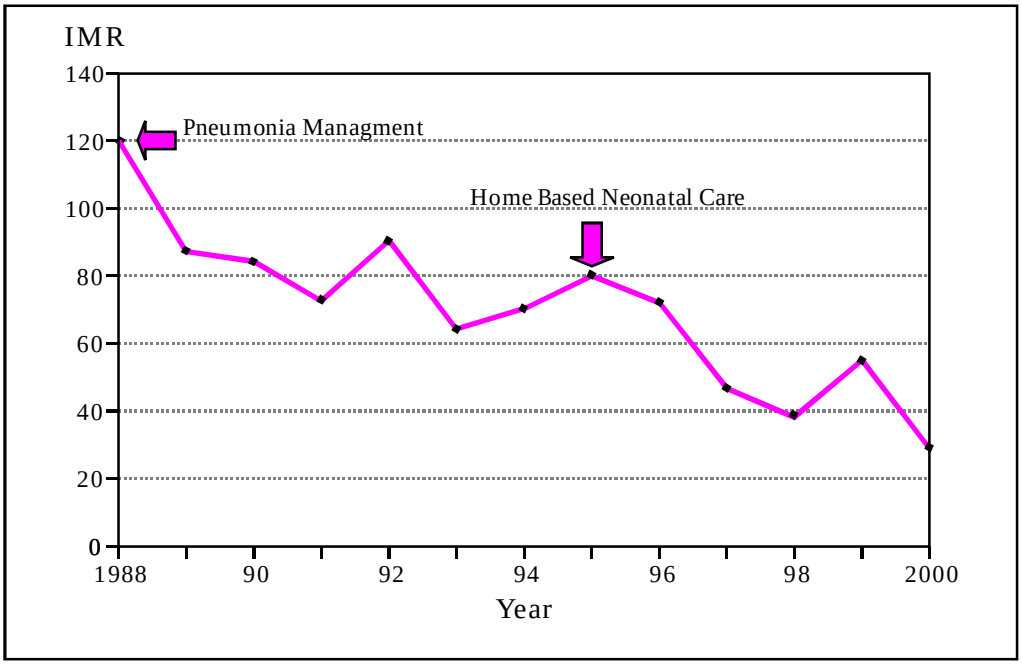
Village health workers and the dais (TBAs) were trained in 39 intervention villages to perform following functions:

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

b) Provide health education to families about care of mother and newborn at home; and monitor the neonates for high risk or sicknesses and manage sick neonates at home (1995 onwards).

The indicators of community acceptance, coverage and the quality were excellent. The effect on the IMR is presented in Figure14.

Figure 14 : Effect of interventions on the IMR
(39 villages in Gadchiroli 1998-2000)



(Bang etal. Journal of perinatology, 2005)

The IMR declined from 121 in 1988 to 30 in the year 2000. Incidentally, reducing the IMR to < 30 by 2010 is the goal of the National Population Policy. Gadchiroli is the poorest and remote district in Maharashtra. Without any non-health inputs, the IMR could be reduced to 30. Hence this offers one possible model for a 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 utilizes and depends on developing the human potential in villages-mothers, village health workers and dais - and is not dependant on employing urban-educated salaried employees who are unwilling to go to rural areas and are costly.
- It is need-based, fulfills the demand for an 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. 300 per newborn baby, or Rs. 6500 per averted death (Bang et al 2005). This is lower than the cost of most health care interventions when converted in to the cost per life year saved (World Bank 1993).

4. Socio-economic Development

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

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 the child mortality are under-recorded and under-estimated.

- The neonatal mortality rate, IMR and the 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, reestimation 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 30.8.

The total annual child deaths in the state are estimated to be nearly 175,000, and the still births 70,000.

- The MIS of the health and FW department of the state government is woefully incomplete, recording only 21 to 24% 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 percent of the IMR, and the high still birth rate : These rates are very high in all 3 types of areas, surprisingly including in the urban slums. The presence of hospitals in the vicinity does not necessarily reduce the NMR and SBR. Hence, the maternal and child health and development programmes need to redefine their priorities and identify appropriate and effective intervention strategies to reduce the NMR. 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 tribal areas and urban slums : The post-neonatal and 1 - 4 year mortality rates were 50% and 100% higher in the slums and the tribal areas respectively, than in rural areas. 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 rest of the state. Thus, in addition to the 'development backlog' of this region which has been earlier estimated (GoM, 1984) 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 fetuses. 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 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 problem of invisible child deaths, and initiating corrective political and administrative measures.

- A community-based health care strategy utilizing 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 the growth and development. And last, it is the acid-test of democratic governance which must demonstrate an 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.

Beyond Research: Social Audit of Child Mortality

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

However, the research findings often fail to achieve 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, Maharashtra 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 department 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 deaths 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 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 the agencies, CRY (Child Relief and You) and Swiss-Aid, who shared the concern about unreported child deaths. The local communities from whom the data were 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 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, the 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% 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 emphasized the goal of 100% 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 public displaying on a board and in the Gram Sabha so that the community could add/correct the list; ii) formation of the 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 child deaths.

The issue was also discussed in both the Legislative Houses. The Health and FW Minister, replying on April 24, 2002 in the Legislative Council, took an ambivalent position. On 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 product of wrong social-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 175,000 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 the child death reporting in the health and FW department by the Registrar General of India, and making the findings public. Instead, the government announced the appointment of ‘The Committee to Evaluate Child Mortality in Maharashtra’ (July 2003). The Committee has submitted two reports (GoM 2004, GoM 2005) which the government has accepted on the floor of the legislative house.

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

1) Public attention and awareness in the state. The media has been extensively sensitized.
2) Sensitisation of the politicians and bureaucracy. The chief minister agreed that child deaths were under-reported, and accepted the goal of 100% 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 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 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 the 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.

Post script :

Child Mortality Evaluation Committee

In response to the demand in the legislative house, the Government of Maharashtra, in December 2003, appointed The Committee to Evaluate Child Mortality in Maharashtra, under the chairmanship of Dr. Abhay Bang. The Committee included experts, NGOs and senior officers of the health department. The Committee submitted two reports. First report on the magnitude and causes of the problem, and second, on the recommended solutions.

Government of Maharashtra, in April 2005, has accepted both reports of the Bang committee, and promised the state legislature to implement the recommendations.

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