Child Survival and Health
India, 2009

Selected Papers of
Bhopal Seminar 2009

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Introduction

Aalok Ranjan

This monograph presents selected papers of the Bhopal Seminar 2009: Contemporary Issues in Child Survival and Health organised by the 'Shyam' Institute. The institution of Bhopal Seminar was established in the year 2000 to promote evidence-based discussion and debate on contemporary issues in population and health in India and its constituent states. The Bhopal Seminar 2009 was the eighth in the series. Since 2007, selected papers of the Bhopal Seminar are published as a monograph for wider discussions. Over the years, the Bhopal Seminar has become an important platform for presenting and discussing research on issues related to population and health.

More than 60 research papers were presented at the Bhopal Seminar 2009. The focus of the Seminar was on child survival and health. Issues discussed during the Bhopal Seminar 2009 included progress towards child survival, child survival policies and programmes, social class differentials, determinants of child survival, child health and nutrition, child survival efforts, and women's health. In addition, there was a symposium on child survival and health in urban areas and two open sessions.

The monograph comprises of 18 papers presented at the Bhopal Seminar 2009. They were selected through an open competitive process. The participants of the Seminar were informed that at least two papers would be selected for publication in the monograph from every technical session by the session chair. The papers so selected were subsequently reviewed and revised on the basis of the comments raised at the time of presentation of the paper and by the reviewer. These

papers present a broad perspective of child survival and health issues in India.

The first paper of the monograph, by Gulati and Singh, analyses the determinants of infant mortality in India on the basis of district level data available from various sources including district level estimates of the probability of death in the first year of life generated from the information available through the 2001 population census. The analysis highlights strong linkages between infant mortality rate and utilisation of antenatal and obstetric care services, marriage patterns, women's empowerment enabling factors, health infrastructure and facilities, and economic development, suggests that strict enforcement of minimum age at marriage can bring about maximum impact towards reduction in infant mortality. The paper also observes that poverty alleviation or pro-poor women centred programme interventions directed towards improving antenatal and obstetric may also bring about faster decline in infant mortality.

The second paper, by Kushwah and Prasad, presents a concise of child survival and health policies and programmes in India. The paper argues that there is still a great deal that needs to be done, especially at the policy level to accelerate improvements in child survival. There is a need to put in place a protective environment for ensuring the survival, growth and development of the child. This protective environment should be addressed at the level of policy and legislation, in terms of improving the efficiency and effectiveness of programme interventions and at the level of advocacy and awareness generation.

Trends in infant mortality in Madhya Pradesh is the theme of the third paper of the monograph. Using the information available through the district level household survey 2007-08, Rajiv Ranjan, concludes that infant mortality has decreased in Madhya Pradesh but it still remains highest in the country. The paper also observes that rural-urban, social class and inter-district differentials in infant mortality are quite substantial in the state and they have persisted over time. It is argued that a district-based approach and an effective behaviour change communication strategy should be evolved for an accelerated reduction in infant mortality in the state. The paper also stresses the need of collaboration and synergistic cooperation between professional and non government organizations, development partners, centres of excellence, etc. to have maximum possible positive impact on child health.

The next paper, by Aalok Ranjan, analyses the progress towards child survival in Madhya Pradesh on the basis of district level estimates

of infant and child mortality generated from the information available through 1981, 1991 and 2001 population census. The analysis suggests that the progress towards child survival in Madhya Pradesh has not been satisfactory in the context of either Millennium Development Goals or objectives of the XI Five-year Development Plan of the state. There has been improvement in the survival probability in the first year of life but improvement in survival probability has faltered during the 1-4 years of life so that improvement in the child survival probability in the age group 0-5 years has almost stagnated. The decrease in the survival probability in children aged 1-4 years suggests an increase in the prevalence of under nutrition in children. The paper stresses the need to revisit current policies and programmes and argues that child survival policies and programmes need to be designed in the broader development context and quality of life and not in the narrow perspective of health imperative that is the case at present.

The next paper of the monograph, by Aalok Ranjan and Arunand Murmu, analyses the progress of child survival efforts in the districts of Madhya Pradesh on the basis of the data available through district level household survey. Using the factor analysis technique, authors found that child survival efforts in the state can be grouped into four dimensions and progress in terms of the four dimensions vary widely across the districts of the state. In some dimensions, the progress has been found to be better than other dimensions. The paper concludes that the progress of child survival efforts in most of the districts of the state is essentially lop-sided and this lop-sidedness appears to be an important reason behind slower than expected transition in infant and child mortality in the state.

Concern about the survival and health of the children of urban poor is the focus of the sixth paper of the monograph. On the basis of a re-analysis of the data available through the National Family Health Survey 2005-06, Agarwal and Srivastav highlight the dichotomy that exists between poor and the non-poor in the urban areas of Madhya Pradesh. The paper argues that improving the health of the urban poor is necessary to achieve the goals set out in national development policies and Millennium Development Goals and stresses that efforts in this direction should focus on a city specific approach, involving communities and scaling up effective interventions for maximum coverage.

An analysis of the impact of infant mortality on fertility is the theme of the seventh paper of the monograph. This paper, by SRJ Singh, is

based on a survey carried out in the rural areas of district Rewa in Madhya Pradesh. The paper observes that, like other studies, there is a direct relationship between infant mortality and fertility. The paper argues that the influence of infant and child mortality on fertility is not an instantaneous adjustment process. In the long run of demographic transition, fertility decline normally lags the decline in mortality including infant mortality. However, the time span of fertility decline and the time span of mortality decline varies considerably from one context to another. If, in a given set of circumstances, it is possible that reduction in infant mortality induces a fall in fertility, then an understanding of the factors affecting the lag become highly pertinent, since it may be possible to reduce the time lag through appropriate policy measures.

The eighth paper of the monograph is directed towards analysing the determinants of birth weight and neonatal mortality on the basis of hospital data. The analysis suggests that the distribution of weight at birth is essentially a Guassian, with additional births at lower end, that divides the distribution in two components; I) a predominant distribution (Guassian) and ii) a residual distribution. It appears that predominant distribution is largely of term births, while the residual distribution is composed of almost entirely of pre-term births. Further, it was observed that the male babies suffer higher risk of perinatal death than female babies, despite the fact that the prevalence of low birth weight is lower in male than in female births. The analysis also reveals that the relationship between neonatal mortality and a host of maternal variables is linear, although the deviation from linearity is also significant. The author argues that such a contradiction is possible because of the large sample size.

Nutritional status plays a very important role in deciding the survival and health status of children and ensuring their normal growth. Using the data available from the latest round of the National Family Health Survey, Verma and Tailor have analysed the correlates of nutritional status of children in Madhya Pradesh. The analysis reveals that nutritional status of children is influenced strongly by social and cultural factors in addition to economic factors. The paper argues that tackling the problem of rampant under nutrition in Madhya Pradesh requires a broad, development oriented approach and not just clinical interventions.

Breastfeeding plays a very important role in child survival and health. Exclusive breast feeding for the first six months of life is

recommended as essential for the survival, health and normal growth of the new born. Dixit and others, in their paper, have analysed prevailing perceptions about breast feeding in an urban community. The paper based on infants attending the immunisation clinic in a city in Madhya Pradesh has also explored the impact of educational interventions to mothers related to the benefits of exclusive breast feeding. The paper concludes that there is a need to formulate innovative community based programs and novel health promotion strategies to universalise breastfeeding for the benefit of infants and young children.

The eleventh paper of the monograph is a comparative analysis of household and environmental risk factors in acute respiratory infections, one of the major cause of childhood mortality, in Madhya Pradesh and West Bengal. On the basis of the information available through the third round of the National Family Health Survey, Sengupta and Lhungdim conclude that analysis of the prevalence of acute respiratory infections (ARI) from an epidemiological perspective should be a priority in research. There is a need to identify social, cultural and environmental factors and their relationship with acute respiratory infections. The paper also emphasises a behavioural shift in terms of promoting the use of stoves and chimneys and making people aware about the importance of improving the quality of housing including ventilation, separate kitchen, electricity, etc. Awareness about health impacts of sanitation and healthy personal lifestyles needs to be disseminated among people as a long-run mechanism to reduce the prevalence of ARI among children and also among adults. The analysis has, however, not been able to explain why despite poorer household environmental and socio-economic conditions in Madhya Pradesh than in West Bengal, the later continues to have a much higher prevalence of ARI. Children in Madhya Pradesh appear to be relatively safe from the risk of respiratory infections than children in West Bengal.

The next three papers of the monograph are related to child health issues in Scheduled Tribes. The first of these three factors, by Saha and others, analyses the perception of Lodha tribes of West Bengal about child health, immunisation and breast feeding on the basis of a survey carried out in 1997. The paper concludes that because of the prevailing perceptions about child related diseases, majority of Lodha tribes do not understand the importance of the utilisation of the available child health facilities and thus make children vulnerable to childhood morbidity and even death. This perception needs to be changed.

The next paper, by Ubaidullah and others, describes the successful provision of integrated comprehensive health services - general health, reproductive and child health, prevention of sexually transmitted infections (STI) including HIV/AIDS, and family planning - to Lambadas, a tribal community living in the rural areas of Khammam District in Andhra Pradesh in India. The authors conclude that it is possible to bring down maternal, infant and child mortality and morbidity to very low levels with programme interventions initiated for the tribal population. Authors also suggest that similar approach may also be replicated in Madhya Pradesh where a large population is tribal and their health status is very poor.

The next paper of the monograph analyses correlates of infant mortality in Gond tribes in Raisen district of Madhya Pradesh on the basis of a survey carried out in 13 villages. The paper, by Gharami, observes that a very high proportion of infant deaths in the Gond families reflects their poor living conditions. It is suggested that educating Gonad women can lead to a substantial reduction in the proportion of infant deaths and improve child bearing as well as health of the entire family.

Preventing deaths during the neonatal period is an important strategy towards promoting child survival and health. Jena and Dubey, in their paper, have discussed the important issue of health emergencies among neonates in Andhra Pradesh. They have also developed a methodology to estimate the prevalence of neonatal complications which require emergency care including transport. The analysis suggests two critical areas to reduce neonatal mortality. First, birth asphyxia can be avoided if such cases are reported as pregnancy related complications. Second, there is a need of early identification of neonatal complications and good pre-hospital care. Facilitating quick and effective transport system is critical in this regard.

Trauma in children is the focus of attention of the next paper of the monograph by Shrivastava and others. Paediatric trauma is one of the major threats to the health and well being of children. Based on the paediatric trauma cases admitted in a teaching hospital in Madhya Pradesh, the paper observes that even though the incidence of paediatric trauma has remained stable, there has been an increase in the number of cases of road traffic accidents and injuries due to mechanical and electrical gadgets. The paper argues that management of paediatric trauma is a specialised job and therefore requires tertiary centres for proper treatment of paediatric trauma victims.

The next two papers of the monograph are related to the nutritional status of women which plays a critical role in child survival, health and development. The paper by Negi and Khan analyses the nutritional status of women in terms of anaemia and body mass index (BMI). Nutritional status of woman is critical in survival, health and development of the child. Using the information available through the National Family Health Survey, the paper concludes that health and nutritional status of women in Madhya Pradesh is largely shaped by socio-economic and demographic factors, either at the individual or at the household level and the number and type of variables and their influence on health of the mother vary significantly across different cultural and regional groups. The challenge before policy makers is to develop institutions that can offer cost effective solutions to problems of access and availability of health and nutrition facilities.

The paper by Tiwari and others, on the other hand, concentrates on the nutritional status of women which is a major determinant of child survival. Using the information available through the second and the third round of the National Family Health Survey, authors conclude that the problem of under nutrition in women of Madhya Pradesh is quite substantial and this problem appears to have aggravated over time. The problem is particularly serious in the rural areas and in Scheduled Castes and Scheduled Tribes whereas in the urban areas of the state, problem of obesity among women appears to be gaining dangerous proportions. The authors have also observed a change in the dietary pattern of the women surveyed.

Papers included in the monograph present an overview of contemporary child survival and health scenario in India and pertinent issues that need to be addressed at the policy and programme intervention levels in the context of Millennium Development Goals and IX Five-year Development Plan objectives. Using the latest data available and innovative approaches of data analysis, these papers provide useful insight into the very complex dynamics of child survival and health in India, especially in those states where the process of demographic and health transition remains slower than expected. This insight may be useful for discussing and debating child survival and health related issues facing India and in revisiting the current child survival and health policies and programmes through the development perspective in the context of the empirical evidence that is now available which may contribute towards an acceleration in the transition in infant and child mortality.

Determinants of Infant Mortality in India
A District Level Analysis

SC Gulati
Raghubansh M Singh

Introduction

India is transcending through interrelated demographic and epidemiological transition and has recorded marked improvements in most of the fertility, mortality and morbidity indicators since independence. Cross country comparison of infant mortality rate (IMR) reveals that one fourth of the global infant deaths are from India. As per the recent estimates from the sample registration system, the infant mortality rate in India was still around 55 infant deaths per 1000 live births in the year 2008 and the improvement has been slow in the recent past despite massive spending of the Government of India on the National Rural Health Mission launched in April 2005 (Government of India 2007, UNICEF 2008). This stagnation in the decrease in the infant mortality rate is haunting Indian development planners, public health policy makers and program implementers. Infant mortality is viewed as a proxy for overall socioeconomic development. Decrease in the infant mortality rate also facilitates fertility reduction through voluntary acceptance of family planning. Moreover, the successes of public health initiatives gets reflected in the improvement in maternal, infant and child health indicators. It appears that improvements in the infant mortality rate in the past has predominantly been the result of the decline in the post-neonatal deaths so that the proportionate contribution of neonatal deaths to infant deaths has now become predominant. It is well known that preventing neonatal deaths is inherently more difficult than preventing postnatal deaths as causative factors behind neonatal deaths are generally endogenous factors like female marital patterns and lower utilisation of antenatal and obstetric care services

(Visaria 2004). In any case, stagnation in infant mortality decline in the recent past is casting aspersions on the reproductive and public health programs in India. The slowdown in the infant mortality decline has been attributed to a decrease in the coverage of immunisation and other basic health interventions (Claeson et al 1999, Measham et al 1999). The national population policy 2000 called to bring down infant mortality rate from almost 68 in 2000 to below 30 by 2010. Similarly, the X Five-year Development Plan of India aimed at reducing infant mortality rate to less than 45 by the year 2007 whereas the National Rural Health Mission (NRHM) reiterated to bring down the infant mortality rate to 30 by 2012. The Mission recognises the importance of health in the process of economic and social development and improvements in the quality of life and emphasises to strengthen public health initiatives through strengthening the reproductive and child health program interventions, especially among the under-served and vulnerable groups of the society. It is however clear that the progress made so far in terms of reduction in infant mortality rate falls too short of the perceived goals.

This study purports to highlight crucial determinants of infant mortality in India. First, the study attempts to elicit strength and nature of inter-linkages between infant mortality, utilisation of antenatal and obstetric care services, marital patterns, factors that contribute to the empowerment of women like women's education and employment, and socioeconomic development factors on the basis of district level analysis. Second, the study attempts to highlight significant factors impacting infant mortality and elicit relative significance of the selected variables to evolve alternative strategic policy interventions towards accelerating infant mortality decline in India.

Methodology

The methodology of the study follows factorial investigations to establish the inter-linkages between infant mortality and use of obstetric and antenatal care services, marital patterns and other selected socioeconomic variables to describe the nature of linkages and to provide semi quantitative insights into the strength of the relationship. Factorial investigations also facilitate selection of right kind of predictor variables to obviate the econometric complications like multicollinearity and right specification of the model in the multivariate analysis. The relative significance of predictor variables has been elicited through

multiple regression equation models to provide alternative strategic framework towards accelerating reduction in infant mortality.

Data Source

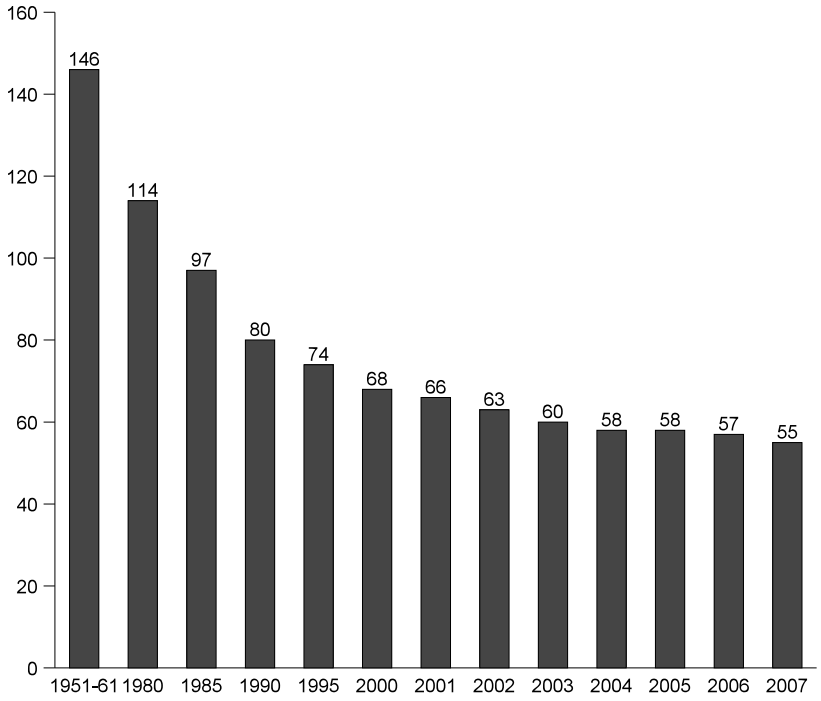
The analysis presented in this paper is based on a number of data sources. District level estimates of infant mortality rate have been taken from Rajan and others (2008). The historical perspective of infant mortality rate in India and its constituent states has been derived through the Sample Registration System. District level data on utilisation of obstetric care services, institutional and safe deliveries, proportion of girls married before 18 years of age, proportion of third and higher order births, etc. are drawn from the second round of the District Level Household Survey conducted in 2002-04 (IIPS 1999). Data on district level health infrastructure and human resources like auxiliary nurse cum midwives and hospital and dispensary beds, etc. is drawn from the database maintained by the Centre for the Monitoring Economy and refers to the year 2000 (CMIE 2000). Data on women's education and labour force participation are drawn from the 2001 population census. Finally, data on district level overall economic development index are drawn from author's earlier study (Gulati 1998).

Trends in Infant Mortality

Infant mortality rate in India decreased quite markedly from 114 during 1950s to 55 in 2007 (Figure 1). Nevertheless, the decrease in the infant mortality rate decelerated during the 1990s as compared to 1980s. Further, infant mortality rate decreased from 68 in 2000 to 58 in 2004 and to just 55 in 2007 which indicates that the infant mortality rate in India almost stagnated at around 58 during the last four to five years. Primary reason for this stagnation appears to be the neonatal mortality rate which showed little decline during the recent past. Neonatal mortality is expected to be difficult to reduce as key factors in neonatal deaths are obstetric care and nutritional standards of the mother (Visaria 2004).

It is obvious to presume that infant mortality rate varies widely across the states and districts in India. The reason is that India is a very large country. It has very diverse social, economic and cultural settings. There is also wide variations in the accessibility and affordability of health and family welfare services with the result that benefits of the health system - public or private - have been very uneven between better-endowed and the more vulnerable sections of society and their

Figure 1
Trends in infant mortality rate in India



poor and deprived counterparts. It has been empirically substantiated that infant deaths are caused by diseases, lack of utilisation of antenatal and obstetric care services, child care, and malnutrition of pregnant women (Bhatt 2004) All these medical factors are influenced by socio-economic status of the person and their attitude towards health-care practices. This is particularly true for women and children who are the most vulnerable group of population and socially disadvantaged sections of the society.

Inter state variations in the infant mortality rate, as obtained through the Sample Registration System, are presented in table 1. These estimates suggest that infant mortality rate varies not only across the states and Union Territories of the country but also between rural and urban areas within the state.

On the other hand, district level estimates of infant mortality rate obtained on the basis of children ever born and children surviving data collected at the 2001 population census suggest that the infant mortality

rate varied from a high of 121 infant deaths per 1000 live births to a low of only 13 infant deaths per 1000 live births.

Structural Linkages between Infant Mortality and Selected Variables

Semi-quantitative insights into inter-linkages between infant mortality rate and selected socioeconomic and reproductive health variables is elicited through factorial investigations. The list of variables used in the analysis and their descriptive statistics is given in appendix tables 1 and 2. Three factors could be retained for the analysis as per Kaiser's criterion of eigen values greater than 1 (Harman 1960). The Varimax rotated factor structure is presented in table 2. The extent of communality varies between 0.34 for religious composition (PMUS) to 0.88 for full antenatal care.

It may be seen from table 2 that utilisation of antenatal and obstetric care services is negatively associated with the infant mortality rate. In districts where utilisation of antenatal care and institutional deliveries are high, the infant mortality rate is low. Similarly, higher is the proportion of safe deliveries, the lower is the infant mortality rate. On the other hand, the higher is the proportion of girls married before 18 years of age, the lower is the infant mortality rate and higher is the fertility higher is the infant mortality rate. Factors that contribute to women's empowerment like literacy and labour force participation also depict a negative impact on infant mortality; similar is the impact of extent of urbanization and overall economic development. Poverty and health infrastructure variables have been found to have a negative association with infant mortality rate. Thus, we find that most of the linkages between infant mortality and selected demographic and socioeconomic variables used in the present analysis have been found to be consistent with general expectations on the basis of the district level information.

Parametric Estimates of Multiple Regression Equation for Infant Mortality

Parametric estimates of the multiple regression equation with infant mortality rate as dependent variable and selected variables related to social and economic development and utilisation of obstetric care services as predictor variables are presented in table 3. Selection of the

predictor variables used in the regression was primarily facilitated by scanning the correlation and factor structure matrix.

Perusal of table 3 suggests that age at marriage depicts significant negative impact on the probability of survival in the first year of life. Alternatively, districts with higher proportion of women marrying below legal age at marriage of 18 years depict significantly higher levels of infant mortality, while accounting for other socio-economic and obstetric care utilisation variables.

Among obstetric care utilisation variables, we find that extent of full antenatal care comprising of three antenatal checkups and administration of requisite IFA tablets and tetanus injections, depict significant negative impact on infant mortality. Similarly, we find that districts with higher proportion of deliveries in health institutions, private or public, also depict significantly lower levels of infant mortality rate. Thus, both antenatal care and institutional deliveries depict significant and negative impact on infant mortality. It has often been viewed that obstetric care not only impacts maternal mortality but also depicts significant impact on neo-natal component of infant mortality and thus infant mortality.

Women's empowerment enabling factors like female literacy and education, and gainful employment are also found to depict significant negative impact on infant mortality. Districts with more educated and gainfully employed working as main-workers depict significantly lower levels of infant mortality. Obviously, empowered women can exercise their rights for seeking health care and better nourishment in the households and thus depict higher chances of survival. We find that districts with relatively higher proportion of population below poverty line depict significantly higher levels of infant mortality. Thus, overall, economic development would facilitate reduction in infant mortality.

Summary and Policy Imperatives

The factorial investigation exercise presented in this study highlights strong linkages between infant mortality rate and utilisation of antenatal and obstetric care services, marriage patterns, women's empowerment's enabling factors, health infrastructure and facilities, and economic development.

The study suggests that strict enforcement of minimum age at marriage act can bring about maximum impact towards reduction in infant mortality. Possibly, higher marriage age among girls would also facilitate improvements in their educational standards, better

employment opportunities, reduction in adolescent fertility. Motivating and sensitising women, especially mothers, about the importance of antenatal care towards the health of the mother and the child can also bring around lot of impact on maternal and infant mortality. Women's education and gainful employment have been elicited to bring relatively much higher impact towards reduction in infant mortality. Overall poverty alleviation or pro-poor women centred program interventions to enhance antenatal and obstetric care can bring around faster declines in infant mortality.

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Table 1
Estimated Infant Mortality Rates in India and states, Year-2007

India and states	Total	Rural	Urban
India	55	61	37
Andhra Pradesh	54	60	37
Assam	66	68	41
Bihar	58	59	44
Chhattisgarh	59	61	49
Delhi	36	41	35
Gujarat	52	60	36
Haryana	55	60	44
Jammu and Kashmir	51	53	38
Jharkhand	48	51	31
Karnataka	47	52	35
Kerala	13	14	10
Madhya Pradesh	72	77	50
Maharashtra	34	41	24
Orissa	71	73	52
Punjab	43	47	35
Rajasthan	65	72	40
Tamil Nadu	35	38	31
Uttar Pradesh	69	72	51
West Bengal	37	39	29
Arunachal Pradesh	37	41	15
Goa	13	11	13
Himachal Pradesh	47	49	25
Manipur	12	13	9
Meghalaya	56	57	46
Mizoram	23	27	16
Nagaland	21	18	29
Sikkim	34	36	20
Tripura	39	40	32
Uttarakhand	48	52	25
Andaman and Nicobar Islands	34	38	23
Chandigarh	27	25	28
Dadra & Nagar Haveli	34	38	18
Daman & Diu	27	29	23
Lakshadweep	24	25	23
Puducherry	25	31	22

Note: Infant Mortality Rates for smaller States and Union Territories are based on three-year average, 2005-07,

Source: Sample Registration System, 2007

Table 2
Varimax rotated factor matrix of the selected variables

Variable	Factor Loadings			Communality
	I	II	III	
IMRT01	-0.589	-0.453	-0.059	0.556
GMB18	-0.401	-0.568	0.301	0.574
ANC	0.858	0.375	-0.046	0.878
InsDel	0.811	0.426	0.075	0.844
InsDelP	0.667	0.342	0.342	0.679
Sdel	0.821	0.435	0.05	0.866
WsRTISTD	-0.591	0.178	0.205	0.423
BO3Plus	-0.827	-0.316	0.06	0.787
LIT_F	0.447	0.698	-0.08	0.693
URBP	0.214	0.68	0.122	0.523
MWORK_F	0.386	0.573	-0.107	0.489
ANM	0.192	0.612	-0.444	0.609
HADBEDS	0.011	0.768	0.083	0.596
PPBPL	-0.266	-0.024	-0.694	0.553
PMUS	-0.169	0.022	0.559	0.342
DDIO	0.251	0.708	0.171	0.593
Eigen Values	4.648	4.031	1.328	

Table 3
Parametric estimates of multiple regression model for infant mortality rate

Predictor Variables	Parametric Estimates			"t"	p
	Regression Coefficient (B)	Standard Error	Standardized Regression Coefficient (Beta)		
(Constant)	69.482	8.194		8.48	0
GMB18	0.204	0.05	0.171	4.062	0
ANC	-0.154	0.071	-0.185	-2.185	0.029
InsDel	-0.14	0.072	-0.152	-1.938	0.053
Sdel	0.065	0.086	0.069	0.764	0.445
WsRTISTD	0	0.055	0	0	0.997
BO3Plus	0.107	0.095	0.067	1.123	0.262
LIT_F	-0.202	0.072	-0.141	-2.8	0.01
MWORK_F	-0.17	0.05	-0.128	-3.371	0
ANM	-0.004	0.013	-0.011	-0.288	0.773
HADBEDS	0.005	0.016	0.011	0.287	0.774
DDIO	-2.39	1.512	-0.064	-1.58	0.115
PPBPL	0.218	0.049	0.144	4.471	0
PMUS	0.031	0.066	0.014	0.462	0.644
R-Square = 0.704; N = 593					

Appendix Table 1
Description of variables used in the analysis

SN	Abbreviations	Description of the Variable (Source)
1	IMRT01	Infant Mortality Rate, 2001 (PFI)
2	GMB18	Girls Marriage below age 18 (DLHS 2)
3	ANC3P	Three ANC check-ups (DLHS 2)
4	InsDel	Institutional Delivery (DLHS 2)
5	InsDelP	Institutional Delivery at Pvt. Hospital (DLHS 2)
6	Sdel	Safe Delivery (DLHS 2)
7	WsRTISTD	Women Suffering from RTI/STDs (DLHS 2)
8	BO3Plus	Birth Order 3+ (DLHS 2)
9	LIT_F	Female Literacy (Census 2001)
10	MWORK_F	Female Work Participation as Main Workers (Census 2001)
11	ANM	Auxiliary Nurse cum Midwife (CMIE)
12	HADBEDS	Hospitals and Dispensary Beds per Lakh Population (CMIE)
13	PMUS	Percent Muslim Population (Census 2001)
14	DDIO	District Development index (Author's Calculations)
15	PPBPL	Percent Population below Poverty Line (CMIE)

Appendix Table 2

Descriptive statistics of variables used in the analysis

SN	Abbreviations	Minimum	Maximum	Mean	Std. Deviation
1	IMRT01	13	121	61.15	22.266
2	GMB18	0.6	85	29.519	18.6825
3	ANC3P	5.4	100	52.232	26.6763
4	InsDel	2.3	100	41.933	24.2061
5	InsDelP	0.1	79	20.059	16.2401
6	Sdel	9	100	56.836	23.529
7	WsRTISTD	1.9	78.4	32.428	14.1069
8	BO3Plus	6.8	76.1	40.432	13.9482
9	LIT_F	18.5	96.06	53.0978	15.50823
10	MWORK_F	13.2	94.79	55.1904	16.7941
11	ANM	3.4	456.54	101.5286	62.92625
12	HADBEDS	7.7	366.98	74.3034	50.56851
13	PMUS	0.04	94.31	10.6069	10.37886
14	DDIO	-1.1	4	0.01	0.5955
15	PPBPL	7	99	52.16	14.669
	Valid N	593			

Child Survival and Health Policies and Programmes

SS Kushwah
Pankaj Prasad

Introduction

Children are principle assets of any country. They are the future of the mankind. It is our responsibility to nurture, solicitude and protect children. Development of the child should therefore be the first priority on the development agenda of any country (Government of India 1974).

India is the home of the largest child population in the world. The importance of children in India's development is reflected in the X Five-year Plan document which underlines the fact that the future of India lies in the future of Indian children – across income groups, geographical locations, gender and communities (Black, Morris and Bryce 2003).

Government of India is making all out efforts for the development and welfare of children. Significant progress has been made in many fields towards assuring basic rights to children. However, much still remains to be done. The country is committed and determined to give the highest priority to the basic needs and rights of all children.

Children are the most vulnerable group of the population and are most exposed to exploitation and abuse. Although, there has been some significant improvement in the situation of children in the country, yet a lot more is still to be done in terms of health, nutrition and education. It is unfortunate that the girl child, in particular, face debilitating discrimination at all stages. Therefore, specific concentration is being given to efforts to improve the life and opportunities of girls.

Child survival, growth and development need to be looked through a holistic perspective as one cannot be achieved without the other. There have to be balanced linkages between education, health and nutrition for proper development of a child.

Survival of infants and young children remains one of the most important issues in the developing world. Around the world, more than 10 million children under five years of age die every year. Levels of under-5 mortality rate vary widely across countries from 4 to over 280 deaths per 1000 live births. About 41 per cent of under-5 deaths occur in sub-Saharan Africa and another 34 per cent in South Asia.

Efforts have been directed to enhance child survival for several decades. Although, infant and child mortality rates are decreasing, yet, they still remain at unacceptably high levels in the developing countries. Twenty to twenty-five per cent of children born in developing countries die before their fifth birthday. This figure is very high when compared to that in the developed countries where only about 2 per cent of children die before the age of five years (Mosley 1985).

Diarrhea, pneumonia, and malaria are the leading killers of children, accounting for nearly half of all child deaths globally. Three of every ten deaths are due to neo-natal causes mainly as a result of birth asphyxia, complications of pre-maturity, sepsis and tetanus. AIDS accounts for 3 per cent of child deaths in the world. This proportion is significantly high in a few African countries.

Overall trends in child survival have been positive in recent years. However, the progress has been uneven with child mortality rate increasing in under developed countries.

The good news is that for nearly all major causes of child death, affordable and effective solutions are readily available. Experts conclude that approximately two-thirds of child deaths can be prevented by available and affordable interventions such as Vitamin A supplements, oral rehydration therapy (ORT), and measles and tetanus immunisation.

As per 2001 census, India has around 157.86 million children below 6 years of age that constitute around 15 per cent of India's population. Out of these, 75.95 million children are girls. The sex ratio among children (0-6 years) as per Census 2001 is 927 females per 1000 males. A significant proportion of these children live in an economic and social environment which impedes physical and mental development of the child. These conditions include poverty, poor environmental sanitation,

infections, inadequate access to primary health care, etc. In addition, inappropriate child caring and child feeding practices, etc also influence the growth and development of the child negatively (Government of India 2008).

In India, about 2.1 million child deaths occur every year. This number is the highest across countries (UNICEF 2004). The national under-five mortality rate is around 85 per 1000 live births, but there are wide variations across states. For example, in 1998-99, the under-five mortality rate varied from 19 per 1000 live births in Kerala to 138 in Madhya Pradesh (IIPS 2000). The World Summit for Children in 1990 called for a worldwide reduction in child mortality below 70 deaths per 1000 live births by the year 2000 (UNICEF 2001). Unfortunately this goal could not be met. The Millennium Development Goal related to child survival is to reduce child mortality by two-thirds between 1990 and 2015 (United Nations 2001). For developing countries, this means a reduction from 105 to 35 under-five deaths per 1000 live births. For South Asia, this implies a reduction from 126 to 42 under-five deaths per 1000 live births by the year 2015. According to estimates prepared by United Nations Children's Fund, child mortality rates have reduced by around 12 per cent between 1990 and 2002 (Jones et al 2006). Given this average annual rate of reduction of 1 per cent per year, the pace of progress will need to be accelerated significantly during the remaining years. For India, attaining the millennium development goal of reduction in child mortality would imply a reduction in the under-five mortality rate to 41 by 2015. There has been a substantial decrease in child mortality in the past two decades in India. The reduction was more marked in the 1980's than in the 1990's. Despite these impressive gains, India compares poorly in the pace of child mortality reduction to several other countries in south and south-east Asia, including Bangladesh. More disturbing are the data which indicate that the decrease in the child mortality rate is slowing down in India (Claeson et al 2000). Infant and child mortality rates in India remain well above the global average. Within India, states like Madhya Pradesh has higher than national infant and child mortality rates. Infant and child mortality rates in Madhya Pradesh, in fact, are the highest amongst all states and Union Territories of the country. This is in quite contrast to Kerala which has the lowest infant and child mortality in the country. A comparison of Madhya Pradesh *vis-a-vis* India and Kerala is presented in table 1 which shows a very poor child survival scenario in Madhya Pradesh.

It may be pointed out here that United Nations Children's Fund considers the under-five mortality rate as the best indicator of social development and well-being (Park 2007). On other hand, infant mortality rate is an important indicator for planning public health services. Major causes of infant deaths in India are:

1) Low birth weight and prematurity
2) Birth injury
3) Sepsis
4) Congenital anomaly
5) Hemolytic diseases of newborn
6) Diarrhoeal diseases
7) Acute respiratory infections
8) Tetanus.

On the other hand, major causes of death in children below five years of age are:

Neonatal causes (37 per cent)
Acute respiratory infections (19 per cent)
Diarrhoeal diseases (17 per cent)
Malaria (8 per cent)
Measles (4 per cent)
HIV/AIDS (3 per cent)
Injuries (3 per cent)
Others including non-communicable diseases(10 per cent)

Child survival index (CSI) is often used to measure the progress towards child survival. CSI is the proportion of those new born who survive to their fifth birth day. It is defined as

Child Survival Index = (1000 – under 5 mortality rate)/10

India has a child survival index of 91.5 per cent as compared to 99.2 per cent in United States of America and 99.6 per cent in Japan. Initiatives have been taken at international, national and state levels to protect and safeguard the child. Internationally, there are various organizations which are constantly working in this field. These include, among others, UNICEF, WHO, CARE, FAO, etc. UNICEF has supported India's BCG vaccination programme right since its inception. It has also assisted in environment sanitation programme emphasising safe drinking water in the rural areas. In collaboration with FAO, UNICEF is also aiding the applied nutrition programme. Currently, UNICEF is promoting GOBI campaign that encompasses four child survival strategies - growth monitoring, oral rehydration therapy, breast feeding and immunisation. FAO, on the other hand, has

organised the World Freedom from Hunger Campaign (FFHC) while CARE-India is supporting a number of child survival related interventions including Integrated Child Development Scheme, Integrated Nutrition and Health Project, Anaemia Control Programme, etc. WHO is supporting India's Pulse Polio Immunisation Programme (Park 2007).

Government of India has also initiated a number of projects to promote child survival such as Integrated Child Development Scheme and reproductive and child health programme. The Integrated Child Development Scheme was launched in 1975. Its components are:

Supplementary Nutrition
Immunisation
Health Checkups & Medical Referral
Vitamin-A prophylaxis
Provision of IFA tablets

The Reproductive and Child Health Programme, on the other hand, comprehensively integrates a range of interventions directed towards improving child health (Park 2007). The programme is focussed on major factors contributing to high infant and under-five mortality. Child health care component of the Programme includes:

Essential Newborn Care
Universal Immunisation
Nutrition
Oral rehydration therapy
Control of acute respiratory infections
Prevention and control of Vitamin-A deficiency
Prevention and control of anaemia
Detection and management of growth faltering

The National Polio Surveillance Programme (NPSP) was started in 1997 with the assistance of DANIDA and USAID. It operates under the managerial control of the World Health Organisation. It helps in detection of cases, case investigation, laboratory diagnosis and mop up immunisation (Park 2007).

Integrated management of neonatal and childhood illness (IMNCI) has been evolved as an integrated package of child health care based on WHO/UNICEF generic guidelines. Indian adaptation of the guidelines includes home based care of new born. It is well known that with the decrease in infant and under-five mortality, an increasing proportion of child deaths are concentrated in the neonatal period (Park 2007). Core components of IMNCI are:

- Improvement in case management skills of the health staff through provision of locally adapted guidelines on IMNCI.
- Improvement in health system required for effective management of childhood illness.
- Improvement in family and community practices.

In 1998-99, Government of India launched the Child Line Service which is a round the clock free phone service that can be accessed by a child in distress or an adult on behalf of the child by dialling 1098. Child Line Service provides emergency assistance to a child. Based upon the need of the child, the child is referred to an appropriate health institution for long-term follow up and care (Government of India 2006). The service focuses on the needs of children living alone on the streets, child labours working in unorganised sector, domestic workers and sexually abused children. The service is currently operational in 73 cities in the country.

The Government of Madhya Pradesh has also launched a number of programmes for the welfare of children. These include:

- Janani Express Yojana which provides round the clock availability of emergency transport named Janani Express for institutional delivery and postnatal and other health emergencies. It is especially available for any complication during pregnancy and for the newborn (Government of Madhya Pradesh 2008).
- Bal Shakti Yojana which aims at severely malnourished children. Nutritional Rehabilitation Centres (NRCs) has been established for their intensive observation and medical treatment. Cost of transport, stay and loss of wage earnings of the accompanying person is also covered. At present 40 NRCs are operational throughout the state and it is planned to increase them to 100 (Government of Madhya Pradesh 2008).
- Matri Shakti Yojana aims at tracking and providing care to women with high risk pregnancies. These women are given 'red card' which entitles them for totally free treatment including medicines and nutrition support (Government of Madhya Pradesh 2008).
- Ladli Laxmi Yojana has led to considerable increase in the number of families who opt for family planning after two daughters. The scheme was launched on January 1, 2006. The scheme is for the benefit of the girl child belonging to below poverty line families. Under the scheme, Rs 6,500 is deposited by the state government in the name of a girl child on the day she is born, which would accumulate to Rupees one lakh after 18 years. This money will be

then handed over to the girl. Following the implementation of this scheme, the negative tendency in the society towards girls has undergone a change. Now, birth of a girl fills a family with happiness and joy (Government of Madhya Pradesh 2008).

- Dhanwatri Block Development Scheme. This scheme is being implemented in 50 high performing development blocks of the state. In the Community Health Centres located in these development blocks, model services are being provided (Government of Madhya Pradesh 2008).
- Integrated Disease Surveillance Project (IDSP) was launched in Madhya Pradesh in 2004 for the surveillance of communicable and non-communicable diseases (Government of Madhya Pradesh 2008).
- Deen Dayal Antyoday Upchar Yojna. The Government of Madhya Pradesh with its commitment to provide social security to the under privileged section of the society launched the Din Dayal Antyoday Upchar Yojana in 2004. Initially the scheme was limited to below poverty line families belonging to Schedule Castes and Scheduled Tribes. Later, the scheme was extended to cover all below poverty line families. The objective of the scheme is to provide free treatment and investigation facility to patients who are hospitalised in government hospitals. The scheme seeks to provide social security coverage to lower socio economic strata of the population and safeguard them from indebtedness arising from illness (Government of Madhya Pradesh 2008).
- Deendayal Chalit Aspatal. This scheme is meant especially for Tribal Blocks of the state. It is run for the upliftment and betterment of child health (Government of Madhya Pradesh 2008).

Constitutional Provisions. There are several provisions in the Constitution of the Republic of India which are relevant for children (Government of India 2008). These include:

- Article 15(3) which provides that, "Nothing in this article shall prevent the state for making any special provision for women and children."
- Article 21 which provides that no person shall be deprived of his life or personal liberty except according to procedure established by law.
- Article 21A which directs the state shall provide free and compulsory education to all children of the age of six to fourteen years in such manner as the state may, by law, determine.

- Article 23 which prohibits trafficking of human beings and forced labour.
- Article 24 which prohibits employment of children below the age of fourteen years in factories, mines or any other hazardous occupation.
- Article 39(e) and (f) which provide that the State shall, in particular, direct its policy towards securing to ensure that the health and strength of workers, men and women and the tender age of children are not abused and that the citizens are not forced by economic necessity to enter avocations unsuited to their age or strength and that the children are given opportunities and facilities to develop in a healthy manner and in conditions of freedom and dignity and that the childhood and youth are protected against exploitation and against moral and material abandonment.
- Article 45 which envisages that the state shall endeavour to provide early childhood care and education for all children until they complete the age of six years.

Legislation. In addition to Constitutional provisions, there are several legislations enacted from time to time that have relevance to the survival, growth and development of children. These include:

1. The Child Marriage Restraint Act, 1929.
2. The Child Labour (Prohibition and Regulation) Act, 1986.
3. The Juvenile Justice (Care and Protection of Children) Act, 2000.
4. The Infant Milk Substitutes, Feeding Bottles and Infant Foods (Regulation of Production, Supply and Distribution) Act, 1992.
5. The Pre-Conception and Pre-natal Diagnostic Technique (Prohibition of Sex Selection) Act, 1994.
6. The Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act, 1995.
7. The Immoral Traffic (Prevention) Act, 1956.
8. The Guardian and Wards Act, 1890.
9. The Young Persons (Harmful Publications) Act, 1956.
10. The Commissions for Protection of Child Rights Act, 2005

National Policy for Children. Keeping in view the Constitutional provisions and United Nations Declaration of the Rights of the Child, Government of India adopted National Policy for Children on 22 August 1974 which states that "It shall be the policy of state to provide adequate services to children, both before and after birth and through the period of growth, to ensure their full physical, mental and social development. The state shall progressively increase the scope of such

services so that, within a reasonable time, all children in the country enjoy optimum conditions for their balanced growth". It further spells out various measures to be adopted and priorities to be assigned to children's programmes with focus on areas like child health, child nutrition and welfare of handicapped and destitute children.

According to United Nations Declaration of the Rights of the Child, development of children has been considered an integral part of national development. The Policy recognises children as "nation's supremely important asset" and declares that the nation is responsible for their "nature and solicitude".

The Government of India has also constituted National Children's Board with Prime Minister as chairmen to look after problems relating to child welfare and their purposeful development. The Board provides policy and direction and reviews programmes for children. Government of India has introduced a number of programmes following announcement the National Policy for Children. These include National Award for Child Welfare, Welfare of the Handicapped, constitution of "National Children's Fund" etc.

National Charter for Children. The Government of India adopted the National Charter for Children which has been prepared after obtaining the views/comments and suggestions of the state governments and Union Territory Administrations, concerned Ministries and Departments and experts in the field. The Charter is a statement of intent embodying Government's agenda for Children. The document emphasises Government of India's commitment to children's right to survival, health and nutrition, standards of living, play and leisure, early childhood care, education, protection of the girl child, empowering adolescents, equality, life and liberty, name and nationality, freedom of expression, freedom of association and peaceful assembly, the right to a family and the right to be protected from economic exploitation and all forms of abuse. The document also provides for protection of children in difficult circumstances, children with disabilities, children from marginalised and disadvantaged communities, and child victims. The document while stipulating the duties of the state and the community towards children also emphasizes the duties of children towards family, society and the Nation.

India acceded to the UN Convention on the Rights of the Child on 11th December 1992 to reiterate its commitment to the cause of children. The objective of the Convention is to give every child the right to survival and development in a healthy and congenial manner.

India is also a signatory to the Millennium Declaration, SAARC Convention on Child Welfare and Combatting Trafficking of Women and Children in the SAARC Region.

National Plan of Action for Children 2005. Ministry of Women and Child Development has prepared a National Plan of Action for Children in 2005 after harmonising the goals for children set in the UN General Assembly Special Session on Children held in 2002, targets set in the X Five-Year Plan, and goals for children in related Ministries/Departments. The Action Plan has been prepared in consultation with concerned Ministries and Departments, States/Union territory Governments, Non Government Organisations and experts. It includes goals, objectives, strategies and activities for improving nutritional status of children, reducing infant and maternal mortality, increasing enrolment ratio and reducing drop out rates, universalization of primary education, increasing coverage for immunisation, etc. The Prime Minister's Office monitors the implementation of the Plan of Action on the basis of the following eight parameters:

1. Reduce infant mortality rate to below 30 per 1000 live births by 2010.
2. Reduction in the child mortality rate to below 31 per 1000 live births by 2010.
3. To reduce maternal mortality ratio to below 100 per 100,000 live births by 2010.
4. Universal equitable access and use of safe drinking water and improved access to sanitary means of excreta disposal by 2010.
5. Universal access to basic sanitation facilities by the rural population by 2012.
6. Elimination of child marriages by 2010
7. Elimination of disability due to poliomyelitis by 2007
8. Reduction in the proportion of infants infected with HIV by 20 per cent by 2007 and by 50 per cent by 2010, by ensuring that 80 per cent of pregnant women have access to ante natal care, and 95 per cent of men and women aged 15-24 have access to care, counselling and other prevention services.

The Commission for Protection of the Child Rights Act 2005. Government of India has recently notified the Commissions for the Protection of Child Rights Act 2005. The Act envisages setting up National and State Commissions. These Commissions would be set up for proper enforcement of child rights and effective implementation of laws and programmes relating to children. The National Commission

for Protection of Child Rights will be a statutory body to be set up under the Commissions for Protection of Child Rights Act. The proposed Commission will have a Chairperson and six other Members, including two women members, a Member Secretary and other supporting staff. The Chairperson would be a person of eminence in the field of child development. The members would be experts in the field of child health, education, child care and development, juvenile justice, children with disabilities, elimination of child labour, child psychology or sociology and laws relating to children. The officers and the staff of the Commission will be provided by the Central Government.

Offences Against Children (Prevention) Bill: Child abuse involves several aspects, such as, sexual exploitation, economic exploitation, domestic violence, trafficking for prostitution, corporal punishment at school, and others. Therefore, Government of India felt a need to have a dialogue on the issue so as to ascertain views from all quarters and to formulate a consensus in order to address the issue more adequately and effectively. Accordingly, consultations have been carried out with voluntary organizations and experts dealing with the subject. It has been decided, after consultations, to constitute a small group consisting of representatives from the Government, NGOs, legal experts and social workers which will go into all aspects of the subject and, after considering all existing legal provisions available on the subject, will formulate draft legislation to address all issues pertaining to child abuse. After wide consultations, a draft Bill for Offences Against Children has been prepared and circulated to the State Governments for their comments and views.

Proposed Integrated Programme for Child Services: As per the 2001 Census, there were 427 million children in the country. There are millions of children living in the difficult circumstances. The child protection programme in India is shared between various Ministries, which have been implementing different schemes and programmes to reach out to varied groups of vulnerable children with complex and diverse needs. The important schemes and programmes for such children include. Programme for Juvenile Justice, Integrated Programme for Street Children, Shishu Griha Scheme, Scheme for Working Children in Need of Care and Protection, General Grant-in-Aid Scheme, Child Line Service, Rajiv Gandhi National Crèche Scheme for the children of working mothers, Pilot Project to Combat the Trafficking of women and Children for Commercial Sexual Exploitation in Destination Areas, etc. However, experiences with the

implementation of existing programmes and polices has brought out a large number of shortcomings in the system.

In view of the gaps identified and recommendations and suggestions received from various quarters, it has been decided to combine the existing child protection schemes under one integrated scheme titled "Integrated Child Protection Scheme". The proposed scheme aims to provide for care and protection of all the children in conflict with law and children in need of care and protection. It would involve steps to strengthen families and prevent them to break-up leading children to become homeless and without care and protection. At the same time, children outside the mainstream need to be provided support beginning from emergency outreach services to final rehabilitation with their families/society. Details of the Scheme are being worked out which is proposed to be implemented in the Eleventh Plan.

All over the world, recognition of child protection as a human rights concept has been fairly recent. The literary works of the time have only romanticised children and their conditions, and has viewed children as their father's property. Legally also, the father is seen as the natural guardian of the child. Patriarchy and its structures approve of this position and in fact justify extreme forms of chastisement of children. The plight of working children, children in institutions and orphans and destitute children living in inhuman conditions is not new to any civilization. The child rights movement in itself is young, much younger than the women's movement. However, ever since the movement for betterment of a child's conditions started gaining momentum and acquired strength, there has been a paradigm shift from care and nurture to protection in a healthy and caring environment. Social justice and the right to life and well-being form the new ideological basis for action (Government of India 2006).

In India, the concept of child rights and the need to create a protective environment has started gaining momentum. However, there is still a great deal that needs to be done. The foremost requirement is the understanding of the fact that for a country with the largest child population in the world, and for the country that wishes to rest on the laurels of its human resources, it is essential for India to put in place the protective environment the child deserves without any further delay.

The prevailing economic and socio-political factors in the country also leave certain groups of children more vulnerable and at risk. Such children are dependent on the Government for providing support,

education, health care, skills development, protection from violence and freedom from exploitation and other needs. It cannot be denied that in the entire South Asian region, they are a particularly neglected group and need special attention. In this regard, the girl child is even more vulnerable than others. It is essential that the creation of a protective environment be addressed at three levels:

- Policy and legislation
- Schemes and funding for their implementation
- Advocacy and creation of a cadre of professionals to carry it forward

Besides the role of the Government, the role of all individuals, communities and families is also critical as the mind set must change for any improvement to come about in the lives of our children. People have now come to understand the importance and relevance of education. Similarly, protection of children must also receive a priority. All actors in civil society and the Government have to cooperate and work towards a coordinated effort to make this movement a success.

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Table 1

Child survival scenarios in India, Madhya Pradesh and Kerala.

S.No.	Mortality rate Per 1000 live births	India	Madhya Pradesh	Kerala
1	Infant mortality rate	57	74	12
2	Early Neonatal mortality rate	25	33	5
3	Neonatal mortality rate	37	50	7
4	Perinatal mortality rate	33	39	11
5	Post-Neonatal mortality rate	23	31	5

Source: Government of India (2005)

Infant Mortality in Madhya Pradesh Evidence from DLHS-2

Rajiv Ranjan

Introduction

Infant mortality rate is an accepted global indicator of the health and socioeconomic status of the population (WHO 1981, WHO 1990). While neonatal health is found to be dependent on the efficiency and effectiveness of healthcare services, post-neonatal health is found to be dependent largely on environmental factors. A high infant mortality rate therefore can be taken to indicate unmet health needs and unfavourable environmental factors.

The fourth Millennium Development Goal has underlined the commitment to improve the health of infants and children. India, along with many other countries have pledged to reduce mortality rate in under-five children by two-thirds by the year 2015 from the baseline set in the year 1990. This goal cannot be met until infant mortality rate is reduced by one half. Although, the world has begun to see significant improvements in child survival, yet mortality in the first year of life virtually remains unchanged.

In the past two decades, there have been a number of initiatives in India to address child survival issues. These include Child Survival and Safe Motherhood Program (CSSM), Reproductive and Child Health Program (RCH) and Integrated Management of Neonatal Childhood Illness (IMNCI) initiative. However, irrespective of these initiatives, the situation related to infant's health remains a major concern and a daunting challenge (WHO 2005). Preventable morbidity such as hypothermia, asphyxia, infections, diarrhoea, malnutrition and respiratory infections continue to lead the table. Basic physiological

support for safe deliveries, appropriate environmental conditions in the labour room, resuscitation facilities, trained nursing staff and pediatricians remain grossly inadequate (Pandey 1998).

India is the second most populous country in the world. One-fourth population of the country is living below the poverty line. Average income of these families is less than Rs 50 per day (UNDP 2004). Every year, more than 27 million children are born in India and 4 million babies die within one year of their birth (WHO 2005). Seventy per cent of children are born at home and more than 50 per cent of the deliveries are attended by unskilled persons. Ante-, intra- and post-natal coverage remains below 50 per cent (Panday et al 1998).

The World Health Report 2005 estimated that only 12 per cent of infants need intensive medical care globally. However, the Indian policy towards child survival has always focussed on medical interventions rather than community based health education or preventative and health promotion activities (Claeson 2000). It is argued that providing medical care to infants is beyond the capacity of available financial, human and technical resources, although, it is proved in a number of empirical studies that two thirds of child deaths can be saved by providing better health information and preventative health services to women and infants (Daly 2000). Major causes of infant deaths are asphyxia, acute respiratory infections, diarrhoea, tetanus, sepsis, injury and congenital defects. They account for 80 per cent of infant deaths of which more than 70 per cent are preventable (WHO 2005).

In this paper, we analyse the trends and inter-district variations in the infant mortality rate in India and explore some of the social and economic correlates of infant deaths on the basis of district level information in Madhya Pradesh.

Data and Methods

The analysis presented in this paper is based on the information available through the District Level Household Survey (DLHS-2) which was carried out during 2002-04 in all the 45 districts of Madhya Pradesh that existed at that time. The number of districts in the state have since increased to 50. During the survey, the birth history of currently married women in the age group 15-44 years was collected which contains records of all live births to the currently married women surveyed irrespective of whether they were alive or not at the time of the survey. For each birth, information about age of the mother at birth,

birth order, whether the child was alive at the time of the survey or not and if not then the age at death was collected along with the family level information about religion, caste, place of residence and standard of living, etc. The infant mortality rate was estimated on the basis of birth history data using Demographic and Health Surveys guidelines (Rutstein, Rojas 2003). According to these guidelines, the following measures were adopted for estimating the infant mortality rate:

Population base	Live births to respondents.
Time Period	Five-year periods of time preceding the survey.
Live Births	Complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of the pregnancy, which, after such separation, breathes or shows any other evidence of life, such as beating of hearts, pulsation of the umbilical cord, or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached (WHO 1950, 1992).
Numerator	Number of deaths among live born during specified age range and specified time period.
Neonatal mortality	Deaths within 30 days of live birth (also includes deaths reported at zero month).
Post neonatal mortality	Deaths at ages 1-11 months (also includes deaths reported as age 31-59 days).
Infant mortality	Deaths at ages 0-11 months (also includes deaths reported as age zero year).

According to these definitions, infant mortality equals the sum of neonatal mortality and post-neonatal mortality. Similarly, under-five mortality is sum of infant mortality and child mortality.

Mortality rates presented in this paper are probabilities calculated through the conventional life table approach. For any calendar period, deaths and exposure are first tabulated for age intervals 0, 1-2, 3-5, 6-11, 12-23, 24-35, 36-47, and 48-59 months and then age-specific probabilities of survival are calculated. On the basis of these probabilities for age segment 0-1 year are produced by multiplying relevant age-specific probabilities and subtracting the product from 1 as

where I is the age interval in months, q_i are the sub interval probability of dying, and ${}_nq_x$ is the conventional probability of dying between age

x to x + n months. Detailed description of the computation procedure is given in Rutstein (1984).

Geographical Boundaries. Madhya Pradesh is one of the largest states of India consisting of, from north to south, upland zones separated by plains. The state straddles the Narmada river, which runs east to west between the Vindhya and Satpura mountain ranges. These mountain ranges and the river Narmada have traditionally separated the north India from the south. The state is bordered on the west by Gujarat; on the northwest by Rajasthan; on the northeast by Uttar Pradesh; on the east by Chhattisgarh; and on the south by Maharashtra.

For the purpose of the present analysis, the 45 districts of the state are grouped in to 6 regions as shown below:

Northern Region	Sheopur , Morena, Bhind, Gwalior, Datia, Shivpuri and Guna
Malwa Region	Neemuch, Mandsaur, Ratlam, Ujjain, Shajapur, Dewas, Jhabua, Dhar, Indore and Rajgarh
South West Region	West Nimar, Barwani, East Nimar, Betul, Harda and Hoshangabad
South Central Region	Katni , Jabalpur, Narsimhapur, Dindori Mandla, Chhindwara, Seoni and Balaghat
Central Region	Sagar , Damoh, Vidisha, Bhopal, Sehore and Raisen
Vindhya Region	Tikamgarh, Chhatarpur, Panna, Satna, Rewa, Umaria, Shahdol and Sidhi.

Demographic, Socio-economic and Health Profile. Madhya Pradesh had a population of 60.4 million at the 2001 population census; the rural urban ratio being approximately 73:27 per cent. Scheduled Castes and Scheduled Tribes accounted for approximately 15 per cent and 20 per cent of the total population. Decennial population growth rate in the state including Chattisgarh during 1991-2001 was 24.3 per cent about 2 per cent points higher than the national growth rate. The state is relatively sparsely populated with an average population density of 196 per square km as against the national average of 274 per square kilometre.

The sex ratio in Madhya Pradesh was 920 females per 1000 males at the 2001 population census which was lower than the national average of 933 females per 1000 males. The sex ratio is higher in rural areas (927 females per 1000 males) compared to urban areas (899 females per 1000 males).

Madhya Pradesh has made impressive advances in literacy during the last decade. The literacy rate increased sharply from 44 per cent in 1991 to 64 per cent in 2001 against the national average of 65 per cent. The female literacy rate is around 50 per cent somewhat lower than the national average of around 54 per cent. Population below poverty line in the state (including Chattisgarh) was estimated to be 43 per cent in a survey carried out in 1987-88 while Planning Commission arrived at a figure of 42.5 per cent in 1995. However, the Madhya Pradesh Human Development Report, 1998 indicates a much lower figure of 31 per cent (vis-à-vis national average of 33.5 per cent). This still means that about 18.8 million people in the state are classified as poor.

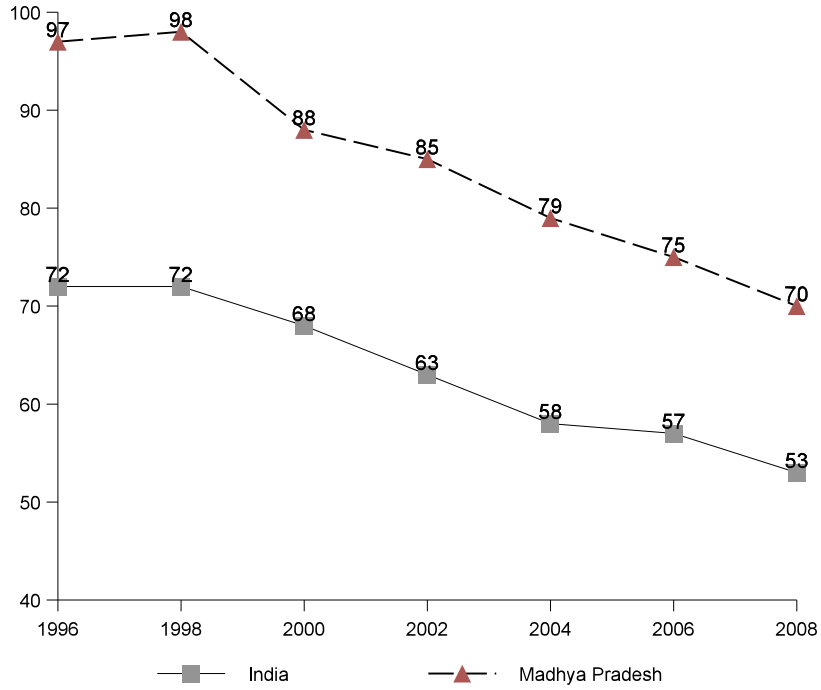
The death rate in Madhya Pradesh was 8.7 per 1000 population in 2007 according to the Sample Registration System which is higher than the national average of 7.4 deaths per 1000 population. In 2007, total fertility rate in Madhya Pradesh was 3.6 live births per woman which was much higher than the national average of 2.3 and far from the replacement fertility (total fertility rate of 2.1 live births per woman).

Results and Discussion

Trends in Infant Morality. Infant mortality has remained very high in Madhya Pradesh currently as well as in the past. According to the National Family Health Survey 2005-06, the infant mortality rate in the state was around 70 infant deaths per 1000 live births around the year 2005 which is lower than the infant mortality rate of 88 infant deaths per 1000 live births estimated around the year 1998. There is a significant difference in the infant mortality rate between rural and urban areas. of the state However, the difference in the risk of death between male and female infants has been found to be only marginal. In case of maternal health care, women of the state are primarily dependent on government maternal health services, especially in the rural areas. About 40 per cent of the women received three antenatal care check up while two thirds of them delivered at home. According to NFHS-3, complete immunisation in children 12-23 months of age is 40 per cent.

Infant Mortality Rate by Selected Background Characteristics. Table 1 presents infant mortality rate in Madhya Pradesh by selected back ground characteristics. The infant mortality rate in female infants was 71.2 per 1000 live birth which is about 13 per cent lower than the infant mortality rate in male infants. The infant mortality rate is much higher in infants with mother's age below 25 years and above 35 years compared to infants with mother's age between 25 through 34 years.

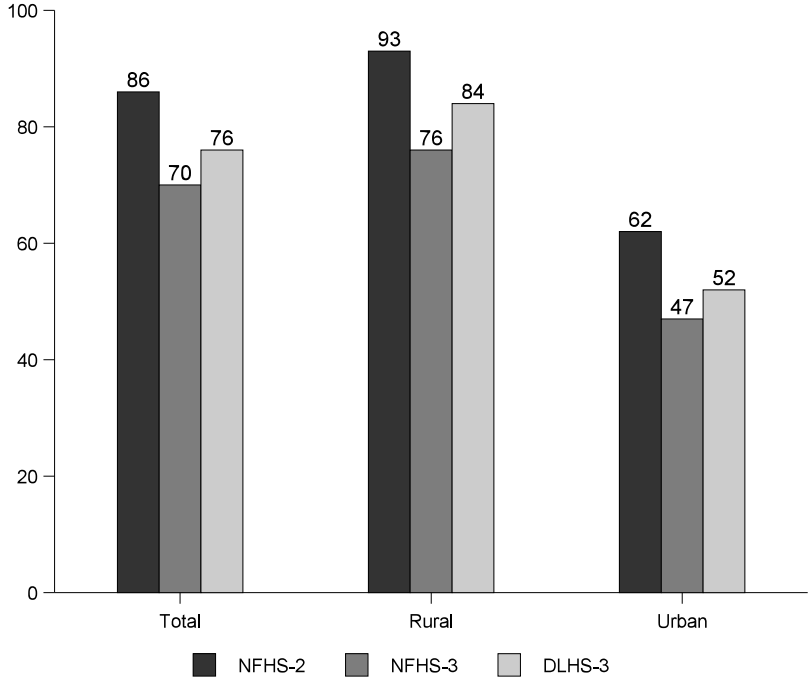
Figure 1
Infant mortality rate in India and Madhya Pradesh



Studies suggest that the higher mortality risk in infants of younger mothers may be related to socioeconomic factors as well as biologic immaturity (Kirchengast and Hartmann 2003). It is also suggested that young maternal age may be a marker for poverty (Phipps et al 2002). In case of older mothers, especially those of low socioeconomic status, infant mortality may be affected by pregnancy complications related to higher maternal age such as gestational diabetes mellitus and hypertensive disorders as well as such factors as multiple births and low socio-economic status (Carolan 2003, WHO 1992, Bajaj et al 2002).

Infant mortality rate is generally higher for the first birth but lowest for the second birth. After the second birth, infant mortality increases with the increase in the birth order. However, in Madhya Pradesh, a different pattern has been observed. The infant mortality rate for first births was 24 per cent lower than that for the second birth. Similarly, infant mortality for the third order births has been found to be 16 per cent lower than that for the second order births.

Figure 2
Infant mortality in rural and urban areas of Madhya Pradesh



Infant mortality rate has been estimated to be the highest in the Scheduled Tribes infants (More than 92 infant deaths per 1000 live births) followed by Scheduled Castes infants (More than 88 per 1000 live births). Mortality in infants belonging to other backward classes is estimated to be 1.5 times the mortality in infants belonging to other castes category.

Infant mortality rate decreases with the increase in the education of the mother and the standard of living as women with more education tend to have higher income levels (US Census Bureau 2003). In Madhya Pradesh, mortality in infants of illiterate mothers is more than 2 times the mortality in infants of mothers having at least 10 years of education. Similarly, mortality in infants belonging to families with low standard of living index has been found to be more than two times the mortality in infants belonging to families with high standard of living index.

Infant Mortality Rate by Region. There continues to be a wide variation in infant mortality rates by the type of residence and sex of the child by region (Table 2) with the highest infant mortality rate being recorded in Vindhya region while the lowest in Malwa region. A large Rural-urban differentials may also be observed across the regions of the state. The rural infant mortality rate is very high in south-central region of the state while the urban infant mortality rate is high in the Vindhya region. Similarly, female infant mortality rate is the highest in the Vindhya region.

Infant Mortality Rate by District. Infant mortality varies widely across the districts of the state (Table 3). The risk of death during infancy is the lowest in district Indore followed by Neemuch, Mandsaur, Jabalpur and Bhopal districts. There are 12 districts in the state where the infant mortality rate is estimated to be more than 100 infant deaths per 1000 live births.

In some of the districts of the state, male infant mortality is lower than female infant mortality while in others, female infant mortality is lower than the male infant mortality. The male infant morality rate is found to be the lowest in district Indore while the female infant morality rate is estimated to be the lowest in district Narsimhapur.

Concluding Remarks and Recommendations

Infant mortality has decreased in Madhya Pradesh but it remains the highest in the country. Available evidence suggests that rural-urban, social class and inter-district differentials in infant mortality are quite substantial and they have persisted over time. These differentials suggest that a district-based approach should be evolved for an accelerated reduction in infant mortality. Besides, there is a need to focus on the vulnerable groups of the population. An effective behaviour change communication strategy should also be evolved and adopted to accelerate reduction in infant mortality.

Government of India has recently launched the National Rural Health Mission in selected states of the country and Madhya Pradesh is one of them. Under the Mission, many on going health program have been geared towards improving maternal health and reducing maternal and child mortality. There is a need to explore new ways of scaling up quality services by ASHA while food supplementation and other child survival issues should get enough attention under the Mission. At the same time collaboration and synergistic cooperation with professional ad non government organizations, development partners and centres

of excellence, among others, should be actively sought and embraced to have maximum possible positive impact on child health.

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Table 1
Selected demographic indicators for Madhya Pradesh and India

Indicators	MP	India
Total population (Census 2001) (in million)	60.4	1028.7
% Urban	26.7	27.8
Decadal Growth (Census 2001) (%)	24.3	21.5
Crude Birth Rate (SRS 2007)	28.5	23.1
Crude Death Rate (SRS 2007)	8.7	7.4
Total Fertility Rate (SRS 2005)	3.6	2.3
Infant Mortality Rate (SRS 2007)	72	55
Maternal Mortality Ratio (SRS 2001 - 2003)	379	301
Sex Ratio (Census 2001)	919	933
Population below poverty line (%)	43	26.1
Schedule Castes population (%)	15.2	16.2
Schedule Tribes population (%)	20.3	8.3
Female Literacy Rate (Census 2001) (%)	50.3	53.7

Table 2
Infant mortality rate for 5-years preceding the survey by region according to place of residence and sex of the child, Madhya Pradesh

Region	Total	Place of Residence		Sex of the Baby	
		Rural	Urban	Male	Female
Vindhya	90.9	93.4	78.7	96.3	84.9
Central	72.6	83.6	51.2	77.2	67.6
Malwa	59.8	66.7	42.6	64.5	54.5
Northern	81.5	89.5	59.4	79.7	83.5
South Central	82.8	94.8	42.4	88.8	76.4
South West	69.9	77.4	41.4	76.5	62.3

Table 3

Infant, mortality rate during five years preceding the survey by background characteristics, Madhya Pradesh

Characteristics	Infant mortality rate
Sex of the baby	
Male	80.2
Female	71.2
Mother's age	
Below 25	80.1
25-34	68.0
35+	72.2
Birth order	
1	61.7
2	81.6
3	73.3
4+	77.4
Education	
Illiterate	87.7
0-9 years	63.8
10 & above	37.7
Caste/tribe	
Schedule castes	88.6
Scheduled Tribes	92.7
Other Backward Classes	74.2
Others	47.8
Standard of living Index	
Low	90.5
Medium	62.5
High	40.5

Note: Rates are specified on a per-thousand basis.

Table 4
Infant mortality rates for 10 years preceding the survey by district and sex of the child, Madhya Pradesh

District	Total	Male	Female
Barwani	74.3	77.3	70.6
Betul	67.1	78.0	54.9
Bhopal	61.6	54.6	68.5
East Nimar	85.0	87.3	82.3
Harda	76.5	85.9	66.5
Mandla	108.4	105.4	111.4
Raisen	82.9	99.1	64.7
Rajgarh	74.4	89.1	59.1
Ratlam	64.0	60.0	68.5
Sehore	81.4	85.6	76.6
Ujjain	74.7	69.6	80.2
West Nimar	67.6	71.8	63.2
Balaghat.	97.3	76.5	116.8
Bhind	94.9	92.8	97.5
Chhatarpur	98.6	97.7	99.7
Chhindwara	86.9	87.6	86.2
Damoh	91.7	102.3	80.7
Datia	104.7	112.5	96.2
Dewas	77.8	66.5	91.2
Dhar	75.9	80.1	71.4
Dindori	89.3	98.1	80.2
Guna	101.9	106.2	97.7
Gwalior	62.0	58.1	66.6
Hoshangabad	100.4	104.7	95.5
Indore	51.4	45.4	57.5
Jabalpur	61.5	70.5	52.0
Jhabua	90.6	97.4	83.9
Katni	110.1	123.6	95.6
Mandsaur	61.2	64.7	57.9
Morena	109.9	90.0	133.7
Narsimhapur	64.8	80.1	48.2
Neemuch	60.0	59.2	60.9
Panna	123.7	130.6	116.3
Rewa	80.9	88.3	72.3
Sagar	107.6	108.9	106.0
Satna	102.0	116.7	87.1

District	Total	Male	Female
Seoni	90.1	102.2	76.8
Shahdol	98.3	88.5	108.2
Shajapur	71.6	76.1	66.9
Sheopur	105.8	112.2	98.2
Shivpuri	72.5	73.2	71.7
Sidhi	78.3	90.8	64.1
Tikamgarh	99.5	115.9	83.4
Umaria	113.1	121.5	104.4
Vidisha	108.3	109.4	107.3

Progress towards Child Survival in Madhya Pradesh: 1981-2001

Aalok Ranjan

Introduction

Madhya Pradesh has the dubious distinction of having the lowest probability of survival in the first five years of life among the constituent states of India. Although, infant mortality in the state decreased from around 145 infant deaths per 1000 live births during 1971-73 to around 74 infant deaths per 1000 live births during 2007, yet the state has always been ranked amongst the poorest state of the country in terms of child survival (Government of India 1999, 2008). Persistence of very high infant and child mortality in the state has a reflection in terms of life expectancy. During the period 1970-75, the expectation of life at birth in Madhya Pradesh was the fourth lowest among the major states of the country (Government of India 1999a). However, during the period 2001-05, the expectation of life at birth in the state was the lowest in the country (Government of India 2007). An accelerated improvement in child survival remains a major development challenge in Madhya Pradesh.

In this paper, we analyse progress towards child survival in Madhya Pradesh between 1981 and 2001 through a district-based approach. Adoption of the district-based approach is important from at least two counts. First, inter-district diversity in almost all aspects of social and economic development is very strong in Madhya Pradesh. It has been argued that reducing the inter-district disparity may be an optimal yet feasible strategy for accelerated improvement in child survival probability in the state.

The second reason for a district-based approach for analysing the progress towards child survival is the recent emphasis on decentralisation of the public health care delivery system in India as articulated in the National Rural Health Mission which has recently been launched by the Government of India to bring about architectural corrections in the health care delivery system (Government of India 2005). One of the objectives of the Mission is the decentralisation of the public health care delivery system so that it can effectively address the health needs of the people. The Eleventh Five-Year Development Plan of the Government of Madhya Pradesh also emphasises a decentralised approach for achieving its goals one of which is the reduction in infant and child mortality (Government of Madhya Pradesh 2007).

A district-based approach in analysing the progress towards child survival in Madhya Pradesh is also required because of the changes in the administrative boundaries of the state. The erstwhile state of Madhya Pradesh that existed before 1 November 2000 was divided into the states of Chhattisgarh and the present state of Madhya Pradesh. As such estimates of infant and child mortality for Madhya Pradesh prior to 1 November 2000 are not comparable to the estimates of infant and child mortality for Madhya Pradesh that existed after 1 November 2000. There has also been a reorganisation of the districts within the state that has resulted in the change in the administrative boundaries of many districts of the state. In 1981 and 1991, there were 45 districts in the state. As the result of the reorganisation of districts in 1998, the number of districts in the state increased to 60. However, with the division of the erstwhile state of Madhya Pradesh into the states of Chhattisgarh and existing Madhya Pradesh, the number of districts in the existing Madhya Pradesh again reduced to 45, although the administrative boundaries of these new districts were not the same as the administrative boundaries of old districts. There are, however, 29 districts in the existing Madhya Pradesh where there has been no change in the administrative boundaries since 1981. The analysis presented here is therefore confined to these 29 districts. These 29 districts accounted for more than 70 per cent population of the state at the 2001 population census.

Data Source

The most commonly used source of data on mortality in India is the Sample Registration System (Government of India 2008). However, the system does not provide district level estimates of the probability of

survival or probability of death by age. District level estimates of child survival probabilities are also not available either from the National Family Health Survey or from the District Level Household Survey. The only source of information at the district level that can be used for estimating child survival probabilities in India is the population census. Information about children ever born and children surviving collected from every currently married women in the reproductive age group at the time of the population census can be used to estimate the probability of survival in the first year of life as well as in the first five years of life (United Nations 1988). Using this approach, the Registrar General of India has prepared estimates of probability of death in the first year of life and in first five years of life on the basis of the information available through 1981 and 1991 population census for all districts in the country (Government of India 1997). Using the same approach, estimates of probability of death in the first year of life and in first five years of life have been prepared by the author on the basis of 2001 population census for the 45 districts of Madhya Pradesh as they existed before 1 November 2000 (Ranjan 2008). Out of these 45 districts, there has been no change in the administrative boundaries since 1981 in 29 districts. It is therefore possible to analyse the progress towards child survival in Madhya Pradesh by measuring the change in the child survival probabilities in these 29 districts. These estimates constitute the basis for the present analysis.

Methodology

The key variable used in the present analysis is the probability of survival from birth to age 5 years ($_5p_0$) which is related to the probability of death in the first five years of life ($_5q_0$) through

$$_5p_0 = 1 - {}_5q_0 \qquad (1)$$

The probability of survival up to 5 years may also be written as

$$_5p_0 = {}_1p_0 * {}_4p_1 \qquad (2)$$

or

$$1 - {}_5q_0 = (1 - {}_1q_0) * (1 - {}_4q_1) \qquad (3)$$

Denoting $_5p_0$ by u, $_1p_0$ by I and $_4p_1$ by c, the change in u over time can be decomposed as

$$\nabla u = u_2 - u_1 = (i_2 - i_1) * c_1 + (c_2 - c_1) * i_1 + (i_2 - i_1) * (c_2 - c_1) \qquad (4)$$

The first term on the right hand side of equation (4) gives the contribution of the change in $_1p_0$ to the change in $_5p_0$ on the assumption that there is no change in $_4p_1$ whereas the second term gives the contribution of the change $_4p_1$ to the change $_5p_0$ on the assumption that

there is no change in ${}_4p_1$. The third term on the right side of equation (4) is the interaction term. It takes into account simultaneous changes in ${}_1p_0$ and ${}_4p_1$. Interaction effects arise because the change in ${}_1p_0$ and the change in ${}_4p_1$ do not add up to the change in ${}_5p_0$. Interaction effects are generally difficult to explain (Horiuchi, Wilmoth and Pletcher 2008). They represent incomplete separation of the contribution of the change in ${}_1p_0$ and the change in ${}_4p_1$ to the change in ${}_5p_0$. As such, it has usually been considered desirable to allocate them among the main effects (Das Gupta 1993). One way is to follow the Goldfield's rule of "allocating interactions to various individual factors on the principle of equal distribution of all variables involved in each interaction" (Durand 1948).

Alternatively, let

$$c = (c_1 + c_2)/2, \text{ and}$$
$$I = (i_1 + i_2)/2,$$

then, it is easy to show that (Kitagawa, 1955)

$$\nabla u = u_2\text{-}u_1 = (i_2\text{-}i_1)*c + (c_2\text{-}c_1)*I$$
$$\nabla u = \nabla I + \nabla c \qquad (5)$$

We shall be using equation (5) to analyse the contribution of the change in ${}_1p_0$ and in ${}_4p_1$ to the change in ${}_5p_0$.

The change in the probability of survival in different age groups also varies by districts. This variability can be captured through the variance of the distribution of the change in the survival probability across the districts. It is easy to show that

$$Var(\nabla u) = Var(\nabla I) + Var(\nabla c) + 2Cov(\nabla i,\nabla c) \qquad (6)$$

where *Var* stands for variance and *Cov* stands for covariance between the variables under consideration. This decomposition reveals how inter-district variation in the change in ${}_1p_0$ and in ${}_4p_1$ contribute to the inter-district variation in the change in ${}_5p_0$. This approach moves the analysis in the direction of the causal analysis, which aims at understanding the sources of variation in ${}_5p_0$ across the districts.

The decomposition of the change in ${}_5p_0$ into the change in ${}_1p_0$ and the change in ${}_4p_1$ is necessary to analyse the progress towards child survival. The reason is that causes of death responsible for mortality in the first year of life are radically different from causes of death that are responsible for mortality in the age group 1-4 years. Information available from the Registrar General of India on causes of death on the basis of medical certification of the cause of death suggests that certain conditions originating in the perinatal period were responsible for 67 per cent of the deaths in the age group 0-1 year in India during the year 1998. This proportion was 87 per cent in Madhya Pradesh (Government

of India 2003). By contrast, infectious and parasitic diseases and diseases of the respiratory system were responsible for majority of the deaths in the age group 1-4 years (46 per cent in India and 74 per cent in Madhya Pradesh). The different causes of death pattern in the age group 0-1 year as compared to the age group 1-4 years suggests that factors influencing ${}_1p_0$ are different from the factors that influence ${}_4p_1$. During the first year of life, the child is exposed to particular stresses and hazards which are not faced by a child in the life after one year (Wills and Waterlow 1958). During the first year of life, key factors that influence the probability of survival are physiological factors, quality of medical care to the mother and the child, especially during pregnancy, at the time of delivery and immediately after delivery and a host of social, economic and cultural attributes (Hijazi 1979). Maternal factors such as nutritional status of the mother, parity, age at pregnancy, etc. also play a very significant role in deciding ${}_1p_0$. On the other hand, key factors that influence ${}_4p_1$ are mainly acute respiratory infections, diarrhoeal diseases, vaccine preventable diseases, especially measles and poor nutritional status of the child (Pan American Health Organisation 1979). Effects of poor nutritional status have been found to be the most severe in young growing children. It has been estimated that almost 60 per cent of deaths in children below five years of age are due to poor nutritional status of children and its interactive effects on diseases that can be prevented easily such as measles, acute respiratory infections, etc. Because of the very strong impact of malnutrition on ${}_4p_1$, it has been advocated that ${}_4p_1$ or, equivalently, ${}_4q_1$ should always be taken to indicate widespread malnutrition among children (Bengoa et al 1959).

Child Survival in Madhya Pradesh

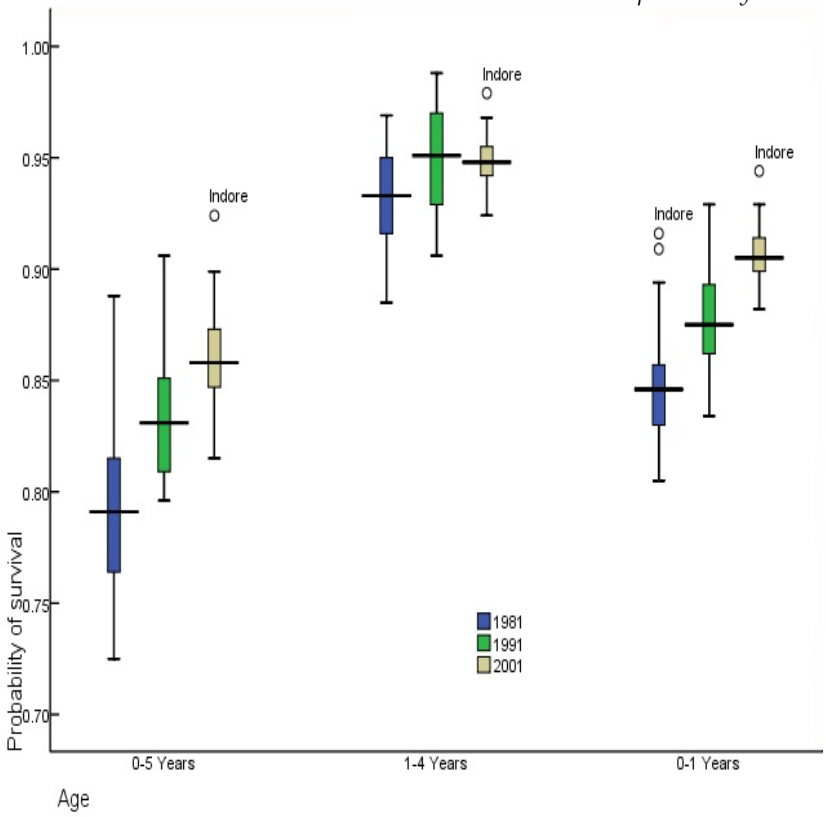
Although child survival probability in Madhya Pradesh has shown an improving trend during the 20 years under reference, yet, it has always remained lower than the national average. Estimates based on the children ever born and children surviving data available through 1981, 1991 and 2001 population census support this observation (Government of India 1997, Ranjan 2008). These estimates suggest that ${}_5p_0$ in Madhya Pradesh increased from 0.803 to 0.859 between 1981 and 2001 as compared to the increase from 0.848 to 0.903 in India. During the same period, ${}_1p_0$ increased from 0.850 to 0.906 in Madhya Pradesh and from 0.885 to 0.931 in India while ${}_4p_1$ increased from 0.945 to 0.948 in Madhya Pradesh but from 0.958 to 0.970 in India. The increase in ${}_4p_1$ has however

been confined to the period 1981 through 1991 as, in both Madhya Pradesh and India, ${}_4p_1$ actually decreased, instead of increasing between 1991 and 2001. As the result of the increase in ${}_4p_1$, the increase in ${}_5p_0$ nearly stagnated in Madhya Pradesh whereas it increased in India during the period 1991 through 2001.

Estimates of child survival probability obtained through the children ever born and children surviving information available through population census suggest that, out of every 1000, 197 live born failed to survive to their fifth birth day around the year 1981. This number reduced to 141 around the year 2001. This means that, between 1981 and 2001, for every 1000 live born, about 56 deaths of children 0-5 years could be saved in Madhya Pradesh (Table 2). In India, by contrast, about 55 deaths of children in the age group 0-5 years could be saved for every 1000 live births. Among the 56 deaths saved for every 1000 live born, 50 were saved during the period 1981 through 1991. By contrast, during the period 1991 through 2001, only about 6 deaths for every 1000 live births could be saved. Moreover, out of the 50 under five deaths saved for every 1000 live births in Madhya Pradesh during 1981 through 1991, about 17 or about one third were confined to the first year of life whereas 33 or about two-third were confined to the age group 1-4 years. During the period 1991 through 2001, however, all the under-five deaths saved were confined to the first year of life. In fact, the number of deaths in the age group 1-4 years increased during the period 1991through 2001 as compared to the period 1981 through1991. Because of this increase in the number of deaths in the age group 1-4 years for every 1000 live born, the number of under five deaths saved during the 1990s decreased substantially compared to under five deaths saved during the 1980s. Interestingly, the number of 1-4 years deaths saved during the period 1981 through 1991 for every 1000 live births were equal to the increase in the number of 1-4 years deaths during the period 1991-2001 as the result of the decrease in ${}_4p_1$ so that there had been neither increase nor decrease in the number of 1-4 years deaths for every 1000 live births during the period 1981 through 2001.

It may also be seen from table 2 that improvement in ${}_5p_0$ during the period 1981 through 2001 was primarily due to the improvement in ${}_4p_1$. However, during the period 1991 through 2001, improvement in ${}_5p_0$ was due to the improvement in ${}_1p_0$ as ${}_4p_1$ decreased, instead of increasing during this period. Obviously, transition in child survival in Madhya Pradesh had a different characterisation in the period 1981 through 1991 as compared to the period 1991 through 2001.

Figure 1
Trends and inter-district variations in child survival probability



Deaths in 1-4 years of age for every 1000 live births increased in India also during the period 1991 through 2001. During the 1980s, around 20 deaths for every 1000 live births could be saved in India as a whole as the result of the improvement in ${}_4p_1$ (Table 2). However, during the period 1991 through 2001, ${}_4p_1$ decreased so that the number of deaths in the age group 1-4 years increased by around 11 for every 1000 live births. As the result of the decrease in ${}_4p_1$, ${}_5p_0$, instead of increasing, decreased marginally in the country as a whole around 2001 as compared to 1991.

Within Madhya Pradesh, level and trend in the child survival probability varied widely across the districts. Summary measures of inter-district variation in ${}_5p_0$, ${}_1p_0$ and ${}_4p_1$ in Madhya Pradesh are given in

Figure 2
Relationship between the improvement and initial level of survival probability in the age group 0-5 years in districts of Madhya Pradesh

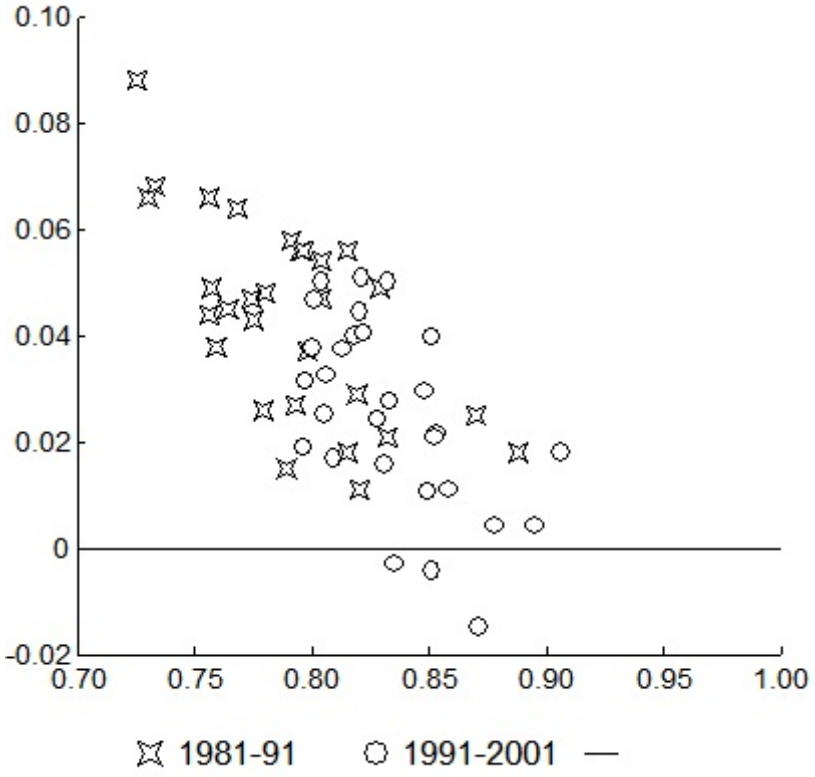
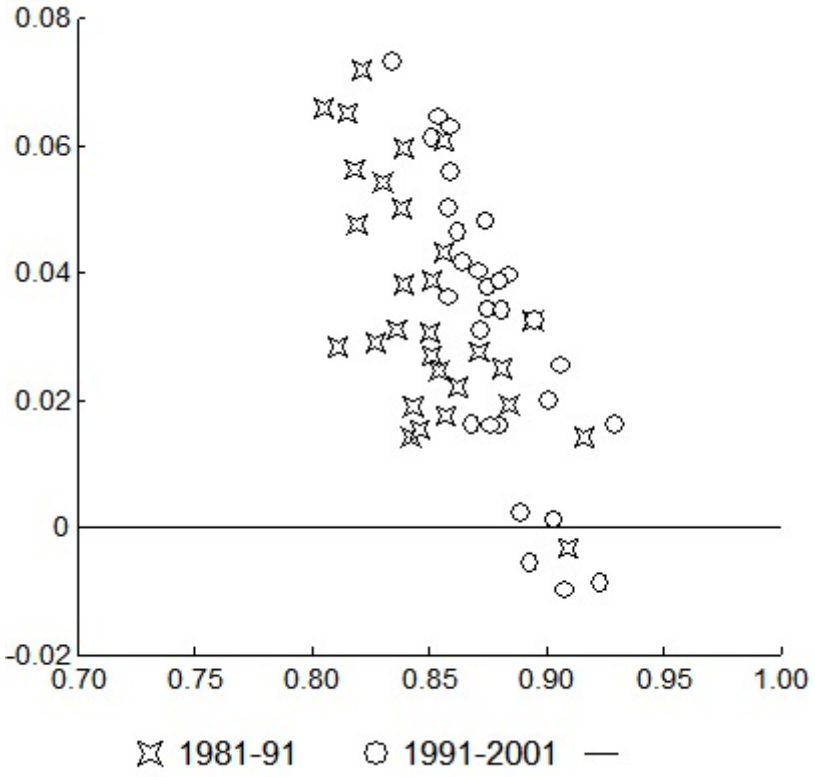


table 3 and presented in Figure 1 for those districts where the administrative boundary remained unchanged during the period under reference. Figure 1 suggests that there has been a consistent improvement in ${}_1p_0$ in all districts between 1981 and 2001. The median ${}_1p_0$ in 29 districts increased from 0.846 to 0.905 while the mean value increased from 0.849 to 0.906. The trend has however not been so consistent in case of ${}_4p_1$. In five districts of the state - Rewa, Sidhi, Jhabua, Seoni and Balaghat - ${}_4p_1$ actually decreased, instead of increasing, in 2001 as compared to that in 1981. In fact, for the 29 districts, the median ${}_4p_1$ decreased marginally in the year 2001 as compared to the year 1991. The reason is that in 15 of the 29 districts

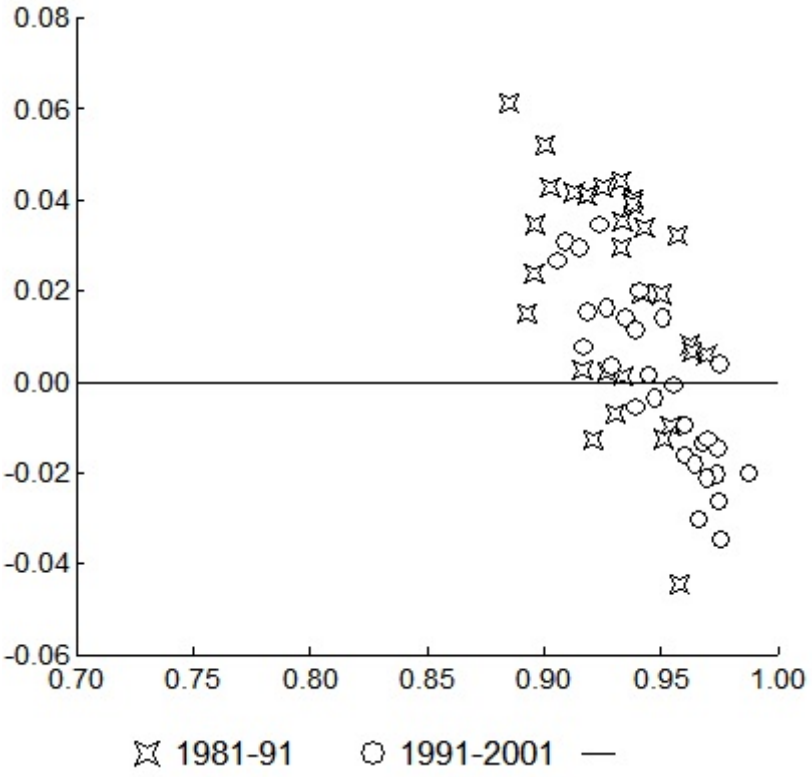
Figure 3
Relationship between the improvement and initial level of survival probability in the age group 0-1 year in districts of Madhya Pradesh



included in this analysis, ${}_4p_1$ decreased during the 1990s. Because of the decrease in ${}_4p_1$, improvement in ${}_5p_0$ slowed down during the period 1991-2001 compared to the period 1981-2001 in most of the districts.

The good sign, however, is that the inter-district disparity or inequality in the three survival probabilities is reducing over time as may be seen from decreasing values of the Gini index and coefficient of variation (Table 3). This implies that the improvement has been faster in districts having relatively low levels of child survival probability as compared to districts having relatively higher level of survival probability. This observation is supported by figure 2 which presents the increase in ${}_5p_0$ during the period 1981-91 and 1991-2001 by the level

Figure 4
Relationship between the improvement and initial level of survival probability in the age group 1-4 years in districts of Madhya Pradesh



in 1981 and 1991 respectively. It is well known that mortality during childhood can be classified into the 'soft' rock of childhood mortality and the 'hard' rock of childhood mortality. When child survival probability is low, most of the child deaths are due causes which constitute the 'soft' rock of childhood mortality. As the child survival probability improves, an increasing proportion of child deaths are due to causes which constitute the 'hard' rock of childhood mortality. The 'soft' rock of childhood mortality can be eroded through low cost appropriate technology such as immunisation and oral rehydration therapy but eroding the 'hard' rock of childhood mortality requires advanced medical technology.

Figure 2 also indicates that improvement in ${}_5p_0$ slowed down during the period 1991-2001 as compared to the period 1981-1991 in most of the districts. During the 1980s, ${}_5p_0$ improved in all the 29 districts of the state included in this analysis, although at varying pace. However, during 1990s, this probability decreased in three districts whereas it improved only marginally in two districts. The very fact that ${}_5p_0$ remained less than 0.900 in all but one district of the state around the year 2001 suggests that the 'soft' rock of under-five mortality is still quite substantial and the state has still to go a long way to achieve levels of child survival as articulated in the Millennium Development Goals. What is even more concerning is the fact that despite prevailing low levels, the pace of improvement in the probability of survival during childhood appears to have slowed down in many districts. It appears that existing child survival efforts in the state have not been able to maintain the pace in the improvement in ${}_5p_0$, especially in ${}_4p_1$ which has actually decreased in the state and in a number of districts during the period 1991-2001.

The foregoing analysis suggests that improvements in the child survival probability in the state has not been uniform. There has been considerable slowdown in the improvement in ${}_5p_0$ during the 1990s as compared to the 1980s because, instead of increasing, ${}_4p_1$ actually decreased in the state as a whole and in many of its districts. Moreover, the pace of improvement in all the three survival probabilities varied widey across the districts. Very little is currently known about the factors and conditions that may be responsible for the increase in ${}_4p_1$ in the state as a whole and in many of its districts during the 1990s. In any case, it appears obvious from the present analysis that the ongoing child survival interventions and programmes have not been able to address causes and conditions that are primarily responsible for the deaths in children in the age group 1-4 years. It is however clear that the factors and conditions that influence the risk of death in the first year of life are essentially different from the factors and conditions that influence the risk of death in 1-4 years of life.

Decomposition of the Change in Survival Probability

The contribution of the change in ${}_1p_0$ and the change in ${}_4p_1$ to the change in ${}_5p_0$ can be measured through the decomposition analysis based on equation (5). Results of the decomposition analysis are presented in

Figure 5
Decomposition of the change in the probability of survival in the age group 0-5 years in districts of Madhya Pradesh during 1981-2001

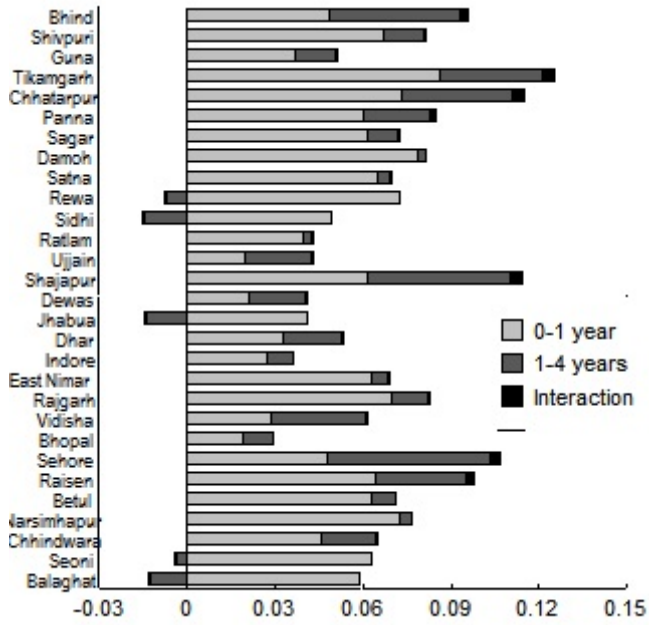
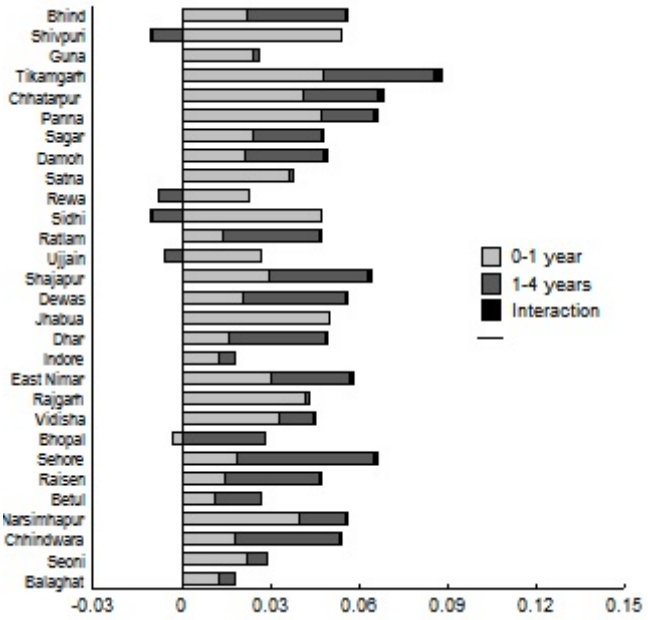


table 4 and depicted in figures 5 through 7. For the state as a whole, almost 95 per cent improvement in ${}_5p_0$ between 1981 and 2001 was the result of the improvement in ${}_1p_0$. Improvement in ${}_4p_1$ accounted for just about 5 per cent of the increase in ${}_5p_0$. The contribution of the increase in ${}_1p_0$ and in ${}_4p_1$ to the increase in ${}_5p_0$ has however been different in the 1980s as compared to 1990s. In the 1980s, improvement in ${}_5p_0$ was largely the result of the improvement in ${}_4p_1$ whereas, in the 1990s, improvement in ${}_5p_0$ was the result of the improvement in ${}_1p_0$ as ${}_4p_1$ decreased instead of improving during this period.

Inter-district variations in the improvement in the probability of survival during childhood have also been found to be very strong.

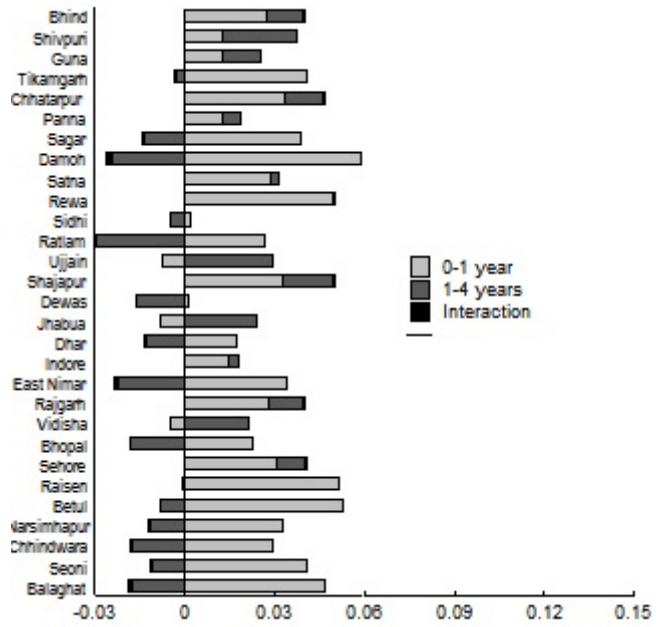
Figure 6
Decomposition of the change in the probability of survival in the age group 0-5 years in the districts of Madhya Pradesh during 1981-91



Absolute improvement in ${}_5p_0$ between 1981 and 2001 ranged from 0.126 to 0.027 across the districts. In four districts the improvement was more than 0.100 whereas in 8 districts it was less than 0.050. Moreover, in most of the districts, at least two-third of the improvement in ${}_5p_0$ was the result of the improvement in ${}_1p_0$. The decomposition analysis also confirms that, compared to the period 1981-91, ${}_4p_1$ decreased during 1991-2001 not only in the state but also in most of its districts.

The inter-district variability in the change in ${}_5p_0$ can be explained in terms of the inter-district variability in the change in ${}_1p_0$ and inter-district variability in the change in ${}_4p_1$. It may be seen from table 5 that inter-district variability in the change in ${}_1p_0$ and inter-district variability

Figure 7
Decomposition of the change in the probability of survival in the age group 0-5 years in the districts of Madhya Pradesh during 1991-2001



in the change in ${}_4p_1$ contributed almost equally to the inter-district variability in the change ${}_5p_0$. During the period 1981-91, however, inter-district variability in the change in ${}_5p_0$ was largely the result of inter-district variability in the change in ${}_4p_1$ but, during the period 1991-2001, the inter-district variability in the change in ${}_5p_0$ was the result of inter-district variability in the change in ${}_1p_0$.

The decomposition analysis also reveals that, in general, ${}_1p_0$ improved in the state and in most of the districts except in district Bhopal during the 1980s and Ujjain, Jhabua and Vidisha districts, during the 1990s. Reasons for the increase in ${}_1p_0$ in these districts are not known. However, it appears that the consistency in child survival

efforts over time as well as across the districts is lacking in the state. Among the districts where ${}_1p_0$ increased either during 1981-91 or during 1991-2001, Bhopal and Ujjain are regarded as comparatively better developed districts with a high proportion of urban population, better literacy levels and a high concentration of health care facilities, especially private health care facilities. On the other hand, Jhabua and Vidisha districts are amongst the most poorly developed districts with low urbanisation, very low level of literacy and near absence of private health care delivery institutions. Similarly, some of the districts where ${}_4p_1$ increased either during 1981-1991 or during 1991-2001 are relatively better developed districts whereas other are relatively poorly developed ones. Obviously, the level of social and economic development in the district may not be the only factor in deciding the levels and trends in child survival probability across the districts. Unfortunately, there has been little systematic attempt to explore the factors that explain the inter-district variations in child survival probability in the state.

Child Survival Policies

The pattern of transition in child survival in Madhya Pradesh, highlighted above, is a reflection of child survival policies adopted by the Government of India and implemented by the Government of Madhya Pradesh. Health and survival of children has been a priority development issue in India even before Independence. The First Health Survey and Development Committee constituted during the colonial rule has devoted one full chapter on health services for mothers and children and another chapter on health services for school children (Government of India 1946). The Committee recommended that all new born should be kept under observation for up to five years and their weight and progress records should be kept in order to ensure their survival, growth and development. After Independence, concern for child survival and health at the policy level is reflected in all Five-year Development Plans. However, issues related to child survival and health were always tagged with issues related to the health of the mother. A prophylaxis schemes was also launched during the 4th Five-year Development Plan to combat nutritional anaemia among pregnant and lactating women as well as children up to five years of age, and prophylaxis against blindness due to vitamin-A deficiency among children under 5 years of age. In the Fifth Five-year Development Plan (1974-78), child survival and health became a component of the Minimum Needs Programme of the Government of India along with

family planning activities. A pilot programme was also launched during the Seventh Five-year Development Plan period for the control of acute respiratory infections, primarily pneumonia, through standard case management practices by paramedical workers.

The real push to child survival efforts in India was given in 1975 when Integrated Child Development Services were launched. The Scheme primarily focussed on weight recording of children and nutrition supplementation to all children who were found to be low weight for age (Government of India, 1975). Subsequently, the Expanded Programme of Immunisation was launched in 1978 which dealt specifically with the disease conditions of children 0-6 years of age and focussed on reducing morbidity and mortality in children through immunisation against vaccine preventable diseases - Diphtheria, Pertussis, Tetanus, Poliomyelitis, childhood tuberculosis and typhoid. The goal was to provide immunisation services to all eligible children and women by 1990 (Sokhey, Kim-farley, Bhargava 1989). The Expanded Programme of Immunisation was replaced by the Universal Immunisation Programme in 1985 which aimed at providing high quality immunisation services to all communities in order to prevent mortality, morbidity and disability from diseases that are preventable through the optimum use of vaccines that are currently available and vaccines that become available from time to time. In addition, the Oral Rehydration Therapy Programme was also launched in the year 1986-87 for reducing mortality due to dehydration caused by diarrhoea among children.

As the result of these programmes and interventions, there has been a marked improvement in ${}_4p_1$ as revealed through the present analysis. Improvement in ${}_1p_0$ was however not as sharp as ${}_4p_1$ because many of these interventions were directed towards children 1-4 years of age. They had only a limited impact on ${}_1p_0$ as they were not designed to effectively address the factors that contribute to the risk of death during infancy, especially factors related to pregnancy and child birth with the result that the gains in ${}_1p_0$ were not as remarkable as the gains in ${}_4p_1$.

The Universal Immunisation Programme and other child survival interventions introduced during the 1980s got subsumed in the Child Survival and Safe Motherhood Programme launched in the year 1992. Although, child survival and health remained one of the key components of this new programme, yet the emphasis was clearly on meeting the reproductive health needs of the people. This shift became more evident and more dominating when the Child Survival and Safe

Motherhood Programme was replaced by the Reproductive and Child Health Programme in 1997, although there had been little change in programme objectives and programme goals. Child survival continued to be one of the important interventions of the programme but the shift in the programme implementation strategy towards reproductive health including neonatal care at the cost of child survival interventions appears to have resulted in a decrease in ${}_4p_1$ in India as well as in Madhya Pradesh and the resulting decrease in India and near stagnation in Madhya Pradesh in the probability of survival in the age group 0-5 years.

Current child survival efforts in Madhya Pradesh are organised under the reproductive and child health component of the National Rural Health Mission which was launched by the Government of India in the year 2007. The Mission aims at architectural corrections in the public health care delivery system. One of the goals of the Mission is the reduction in the infant mortality rate. The Mission is however silent about the risk of death in the age group 1-4 years. Similarly, the XI Five-year Development Plan of Madhya Pradesh aims at reducing the infant mortality rate to 40 infant deaths per 1000 live births but there is no reference to mortality in children 1-4 years of age (Government of Madhya Pradesh 2007). The National Population Policy, announced in the year 2000, does not have any reference to mortality in children 1-4 years of age (Government of India 2000).

The unacceptably high levels of the risk of death in children aged 1-4 years and the increase in this risk in many districts of the state appears to be a reflection of the poor nutritional status of children. It is argued that mortality in children 1-4 years of age is high in populations where post weaning nutrition is poor (Le Gros Clark 1951). On the basis of the relationship between the risk of death and the nutritional status of children aged 1-4 years, it is also argued that mortality in 1-4 years of age can be equated to some extent with under nutrition in early childhood and the death rate in the age group 1-4 years may be treated as an index of under nutrition among children (Wharton 1971, Wills and Waterlow 1958). It has also been estimated that nearly 60 per cent of deaths in children under 5 years are due to under nutrition and its interactive effects on preventable diseases like diarrhoea and pneumonia. Most of these deaths are confined to the age group 1-4 years as effects of poor nutrition are the most severe in young growing children.

The decrease in ${}_4p_1$, in the context of the above arguments suggest that the prevalence of malnutrition in children below 5 years of age in Madhya Pradesh and in Many districts of the state has increased over time. This conjecture is supported by the information available through the National Family Health Survey according to which, the proportion of low weight for age children in the state increased from around 51.1 per cent in 1992 to almost 58 per cent in 2005-06 (International Institute for Population Sciences 1995, 2007). The National Family Health Survey also suggests that more than 60 per cent of the children aged 1-4 years were low weight for age.

The state response to the problem of malnutrition in children below five years of age has been in the form of *Bal Sanjivani* Campaign (Government of Madhya Pradesh 2009). Launched in the year 2001, the *Bal Sanjivani* Campaign essentially comprised of weighing of all children below five years of age and grading of children according to their nutritional status on the basis of Gomez scale. The severely malnourished children identified through the campaign or otherwise were given a rehabilitation package comprising of hospitalisation for a period of 14 days. Nutrition Rehabilitation Centres have been established in the public health care delivery institutions for the purpose. However, there is no intervention for children with mild and moderate grade malnutrition.

Since 2001, twelve *Bal Sanjivani* campaigns have been organised throughout the state and it is claimed that the Campaign has resulted in a significant decrease in the prevalence of low weight for age children. However, results of the *Bal Sanjivani* campaign do not conform to the findings of the National Family Health Survey which suggests that the prevalence of low weight for age children in the state has increased between 1998-99 and 2005-06. There are some serious concerns about the quality of data on nutritional status of children available through the *Bal Sanjivani* campaign. A process evaluation of the campaign carried out in 2004 reported that one third of the Aanganwadi workers were not able to identify the nutritional grade of the child and 30 per cent were not having the record of the weight of children who were not enrolled at the Aanganwadi centre (Government of Madhya Pradesh 2004). Although, *Bal Sanjivani* campaign was designed to increase the awareness of the community about nutritional status of children and how to monitor the normal growth of the child, yet, there have been little substantial efforts to address the issue other than hospitalisation of children with severe under nutrition. There has

also been little followup of those severe under nourished children who were discharged from hospitals/nutritional rehabilitation centres.

One of the major drawbacks of the official approach towards child survival in India and in Madhya Pradesh is that child survival efforts have not been designed, planned and implemented in the context of the disease burden in children. Rather, they have increasingly been driven by the medical technology and associated supply side push and implemented in a normative manner (Madhvi, 2003). There is little empirical evidence in India and in Madhya Pradesh about the pattern of morbidity and mortality in children that may constitute the basis for child survival efforts. Epidemiological considerations such as prevalence rates of common childhood illnesses and causes of child deaths are simply not available. Since, morbidity and mortality in childhood is strongly conditioned by local conditions, it is imperative that this information must be available at the grass roots level so that the local context of child survival is imbedded into child survival efforts. However, there has hardly been any noteworthy attempt in this direction. The only source of information for estimating child mortality below the state level continues to be the information on children ever born and children surviving collected during the decennial population census. Even this information is available up to the district level only. Below the district level, no information on child mortality is available. On the other hand, there is hardly any information about childhood morbidity even at the state level that may constitute the basis for child survival and child health interventions.

Another concern is that there is no mechanism to measure the impact of child survival efforts on morbidity, disease burden and mortality of children. Performance of child survival efforts is generally measured in terms of output indicators like coverage rates of different child survival interventions but the link between output indicators and the impact indicators remains ill-defined, especially at the grass roots level - the interface with the people - primarily because information related to morbidity and mortality among children is missing.

It is obvious that policies and programmes towards child survival and health in the state needs reinvigoration in view of the fact that the risk of death in the age group 1-4 years continues to be unacceptably high and appears to have increased over time. Since, both levels and trends in child survival probability varies widely across the districts, a decentralised, district based approach is required to plan for child survival and child health interventions which may be extended right up

to the village level in due course of time. This is a tall order as the district level capacity to organise these efforts does not exist at present. Building a reliable and efficient child survival and child health information system, especially at the district level appears to be the key to reinvigorate child survival efforts and to accelerate the improvement in the child survival probability in the state. This will ensure evidence-based planning for child survival and an objective assessment of the impact of child survival interventions. There is, however, little initiative in this direction.

Conclusions

The analysis presented here suggests that the progress towards child survival in Madhya Pradesh does not appear to be satisfactory in the context of either the Millennium Development Goals or XI Five-year Development Plan objectives. There has been improvement in the survival probability in the first year of life but improvement in survival probability in the age group 1-4 years has faltered so that improvement in the child survival probability in the age group 0-5 years almost stagnated in Madhya Pradesh during the 1990s. The decrease in the survival probability in children aged 1-4 years suggests an increase in the prevalence of malnutrition in children, an observation which is also supported by the information available from other sources. It is in this context that the current policies and programmes directed towards survival of children in the state need to be revisited. It is important that child survival policies and programmes are designed in the broader development context and improvements in the quality of life and not in the narrow perspective of health imperative that is the case at present. Child survival needs to be viewed as perhaps the most sensitive indicator of social and economic development and the quality of life. Improving the survival chances of the new born is not only a human rights imperative but also a sound economic decision.

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Table 1
Survival probability in different age groups of the childhood period in Madhya Pradesh and India.

Year	Madhya Pradesh			India		
	1981	1991	2001	1981	1991	2001
${}_5p_0$	0.803	0.853	0.859	0.848	0.906	0.903
${}_1p_0$	0.85	0.867	0.906	0.885	0.923	0.931
${}_4p_1$	0.945	0.984	0.948	0.958	0.982	0.97

Source: Government of India (1997) and Ranjan (2008)
Remarks: Estimates for the year 1981 and 1991 are for undivided Madhya Pradesh whereas estimates for the year 2001 are for the existing Madhya Pradesh.

Table 2
Distribution of under-five deaths (for every 1000 live births) in Madhya Pradesh and India by age

Age group (years)	Madhya Pradesh				India			
	Number of deaths for every 1000 live births			Number of deaths saved for every 1000 live births between 1981 and 2001	Number of deaths for every 1000 live births			Number of deaths saved for every 1000 live births between 1981 and 2001
	1981	1991	2001		1981	1991	2001	
39813	150	133	94	56	115	77	69	46
39816	47	14	47	0	37	17	28	9
39817	197	147	141	56	152	94	97	55

Source: Author's calculations.

Table 3
Estimates of ${}_1p_0$, ${}_4p_1$ and ${}_5p_0$ in districts of Madhya Pradesh, 1981, 1991 and 2001

Districts	${}_1p_0$			${}_4p_1$			${}_5p_0$		
	1981	1991	2001	1981	1991	2001	1981	1991	2001
Bhind	0.871	0.895	0.924	0.913	0.951	0.964	0.795	0.851	0.891
Shivpuri	0.821	0.880	0.894	0.921	0.909	0.937	0.756	0.800	0.838
Guna	0.850	0.876	0.890	0.916	0.919	0.933	0.779	0.805	0.830
Tikamgarh	0.805	0.858	0.901	0.901	0.948	0.944	0.725	0.813	0.851
Chhatarpur	0.818	0.864	0.900	0.896	0.927	0.942	0.733	0.801	0.848
Panna	0.815	0.868	0.882	0.896	0.917	0.924	0.730	0.796	0.815
Sagar	0.836	0.862	0.902	0.933	0.961	0.945	0.780	0.828	0.852
Damoh	0.811	0.834	0.895	0.933	0.966	0.937	0.757	0.806	0.839
Satna	0.819	0.858	0.889	0.927	0.929	0.932	0.759	0.797	0.829
Rewa	0.827	0.851	0.903	0.954	0.945	0.946	0.789	0.804	0.854
Sidhi	0.839	0.889	0.891	0.951	0.939	0.934	0.798	0.835	0.832
Ratlam	0.857	0.872	0.899	0.938	0.976	0.942	0.804	0.851	0.847
Ujjain	0.894	0.923	0.915	0.931	0.924	0.956	0.832	0.853	0.875
Shajapur	0.851	0.884	0.919	0.902	0.941	0.960	0.768	0.832	0.882
Dewas	0.881	0.903	0.904	0.925	0.965	0.947	0.815	0.871	0.856
Jhabua	0.856	0.908	0.899	0.958	0.915	0.942	0.820	0.831	0.847
Dhar	0.884	0.901	0.919	0.938	0.974	0.960	0.829	0.878	0.882
Indore	0.916	0.929	0.944	0.969	0.975	0.979	0.888	0.906	0.924
East Nimar	0.839	0.871	0.906	0.943	0.975	0.949	0.791	0.849	0.860
Rajgarh	0.830	0.875	0.905	0.934	0.935	0.948	0.775	0.818	0.858
Vidisha	0.856	0.893	0.888	0.893	0.906	0.930	0.764	0.809	0.826
Bhopal	0.909	0.906	0.929	0.957	0.988	0.968	0.870	0.895	0.899
Sehore	0.854	0.875	0.908	0.885	0.939	0.950	0.756	0.822	0.863
Raisen	0.843	0.859	0.913	0.918	0.956	0.955	0.774	0.821	0.872
Betul	0.842	0.854	0.909	0.942	0.960	0.951	0.793	0.820	0.864
Narsimhapur	0.838	0.880	0.914	0.950	0.968	0.955	0.796	0.852	0.873
Chhindwara	0.862	0.881	0.911	0.933	0.974	0.954	0.804	0.858	0.869
Seoni	0.851	0.874	0.916	0.962	0.970	0.958	0.819	0.848	0.878
Balaghat	0.846	0.859	0.907	0.963	0.970	0.949	0.815	0.833	0.861
Gini Index	0.018	0.014	0.008	0.014	0.014	0.007	0.026	0.019	0.015
CV (x1000)	0.04	0.02	0	0.02	0.02	0	0.11	0.04	0.03

Source: Government of India (1997), Ranjan (2008)

Table 4
Decomposition of the change in ${}_5p_0$ into the change in ${}_1p_0$ and ${}_4p_4$ in districts of Madhya Pradesh, 1981 through 2001

District	1981-91			1991-2001			1981-2001		
	∇u	∇I	∇c	∇u	∇I	∇c	∇u	∇I	∇c
Bhind	0.06	0.022	0.034	0.040	0.028	0.012	0.096	0.05	0.046
Shivpuri	0.044	0.054	-0.010	0.038	0.013	0.025	0.082	0.068	0.014
Guna	0.026	0.024	0.002	0.025	0.013	0.012	0.051	0.037	0.014
Tikamgarh	0.088	0.049	0.039	0.038	0.041	-0.003	0.126	0.089	0.037
Chhatarpur	0.068	0.042	0.026	0.047	0.034	0.013	0.115	0.075	0.039
Panna	0.066	0.048	0.018	0.019	0.013	0.006	0.085	0.061	0.024
Sagar	0.048	0.025	0.023	0.024	0.038	-0.014	0.072	0.062	0.010
Damoh	0.049	0.022	0.027	0.033	0.058	-0.025	0.082	0.079	0.003
Satna	0.038	0.036	0.002	0.032	0.029	0.003	0.070	0.065	0.004
Rewa	0.015	0.023	-0.008	0.050	0.049	0.001	0.065	0.072	-0.007
Sidhi	0.037	0.047	-0.010	-0.003	0.002	-0.005	0.034	0.049	-0.015
Ratlam	0.047	0.014	0.033	-0.004	0.026	-0.030	0.043	0.039	0.003
Ujjain	0.021	0.027	-0.006	0.022	-0.008	0.029	0.043	0.020	0.023
Shajapur	0.064	0.030	0.034	0.050	0.033	0.017	0.114	0.063	0.051
Dewas	0.056	0.021	0.035	-0.015	0.001	-0.016	0.041	0.022	0.020
Jhabua	0.011	0.049	-0.038	0.016	-0.008	0.024	0.027	0.041	-0.014
Dhar	0.049	0.016	0.033	0.004	0.017	-0.013	0.053	0.033	0.020
Indore	0.018	0.013	0.005	0.018	0.015	0.004	0.036	0.027	0.009
East Nimar	0.058	0.031	0.027	0.011	0.034	-0.023	0.069	0.063	0.005
Rajgarh	0.043	0.042	0.001	0.040	0.028	0.012	0.083	0.071	0.012
Vidisha	0.045	0.033	0.012	0.017	-0.005	0.021	0.062	0.029	0.033
Bhopal	0.025	-0.003	0.028	0.004	0.022	-0.018	0.029	0.019	0.010
Sehore	0.066	0.019	0.047	0.041	0.031	0.009	0.107	0.050	0.057
Raisen	0.047	0.015	0.032	0.051	0.052	-0.001	0.098	0.066	0.032
Betul	0.027	0.011	0.016	0.044	0.053	-0.008	0.071	0.063	0.008
Narsimhapur	0.056	0.040	0.016	0.021	0.033	-0.012	0.077	0.072	0.004
Chhindwara	0.054	0.018	0.036	0.011	0.029	-0.018	0.065	0.046	0.019
Seoni	0.029	0.022	0.007	0.030	0.040	-0.011	0.059	0.062	-0.004
Balaghat	0.018	0.013	0.005	0.028	0.046	-0.02	0.05	0.058	-0.013

Source: Author's calculations.

Table 5
Decomposition of inter-district variation in the change in ${}_5p_0$ into inter-district variation in the change in ${}_1p_0$ and the change in ${}_4p_1$ in Madhya Pradesh

Inter-district variation	1981-91	1991-2001	1981-2001
Var (∇u)	0.000337	0.000261	0.000698
Var (∇I)	0.000361	0.000299	0.000348
Var (∇c)	0.000191	0.000322	0.000344
Cov(∇I, ∇c)	-0.000108	-0.000142	0.000003

Source: Author's calculations

Progress of Child Survival Efforts in Districts of Madhya Pradesh

Aalok Ranjan
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Introduction

The purpose of this paper is to measure the progress of child survival efforts in districts of Madhya Pradesh. It is well known that infant and child mortality can be reduced substantially just by ensuring that proven interventions are delivered to all children and mothers who need them (Jones et al 2003). It has been estimated that nearly two-third of the global under-five child deaths can be prevented just by achieving universal coverage of selected low cost interventions such as breast feeding, oral rehydration therapy, immunisation against vaccine preventable diseases, proper spacing between successive births, proper complimentary feeding, etc. Application of this approach to India suggests that in a state like Madhya Pradesh where child survival continues to be alarmingly poor, more than 70 per cent of the deaths in children below 5 years of age can be prevented through these low cost interventions (Jones, Schultink and Babille 2006). What is important for the success of these interventions is that these interventions can be delivered at the household level. These interventions limited external material or technical inputs so that child survival remains essentially a low cost, affordable to all, affair. The critical issue in this approach towards child survival is the universalisation of these low cost interventions. In India, these interventions are implemented through the Reproductive and Child Health Programme which is the lead programme of the National Rural Health Mission launched in the year 2005 (Government of India 2005).

Madhya Pradesh is one of those states of India where the risk of death during childhood has remained amongst the highest in the country currently as well as in the past. Although, infant and child mortality rates are declining in the state, yet, there is a need to accelerate the decline by scaling up such interventions like immunisation, use of oral rehydration salt, practice of family planning methods, etc. At present, coverage of these interventions is well below the desired level and there is ample scope for improvement. An analysis of the progress towards scaling up of these interventions is therefore necessary through the programme perspective. Since infant and child mortality rates in Madhya Pradesh vary widely across its constituent districts, it is obvious that such an analysis needs to be carried out at the district level.

It may however be emphasised that child survival efforts are not the only determinants of infant and child mortality. There are a host of social, cultural, economic and environmental factors which also influence the risk of death during infancy and childhood. Many of these factors are beyond the control of programme managers. The importance of child survival efforts, however, lies in the fact that they are subject to managerial control and most of these efforts do not require advanced medical technology or an advanced level of social and economic development for there successful and effective implementation.

Data and Methodology

The analysis is based on the data related to selected indicators of child survival efforts available through the District Level Household Survey 2002-04 and 2007-08 initiated by the Government of India in 1997 to provide district level estimates of selected health indicators to assist policy makers and programme managers in decentralised planning, monitoring and evaluation. The first district level household survey was carried out in 1998-99. Since then, the survey has been repeated in 2002-04 and 2007-08. Incidently, this survey is the only source of information about key health related indicators at the district level. A comparison of the estimates based on 2002-04 survey with that carried out in 2007-08 provides an idea about the progress of child survival efforts in the districts of the state. In Madhya Pradesh, the 2002-04 survey covered 46,413 households whereas in the 2007-08 round, 51,419 households were covered which were distributed across all the districts as they existed at the 2001 population census. In each district, approximately 1000-1100 households were selected through a multi stage sampling

scheme to collect information related to key indicators of reproductive and child health.

The methodology of measuring and analysis the progress of child survival efforts comprised of measuring the change in the level of selected indicators of child survival efforts between 2002-04 and 2007-08. The analysis focusses on the following five most common interventions for preventing child deaths:

- Care of the mother during pregnancy.
- Care at the time of delivery.
- Immunisation against vaccine preventable diseases
- Family planning
- Oral rehydration therapy for prevent deaths due to dehydration during diarrhea

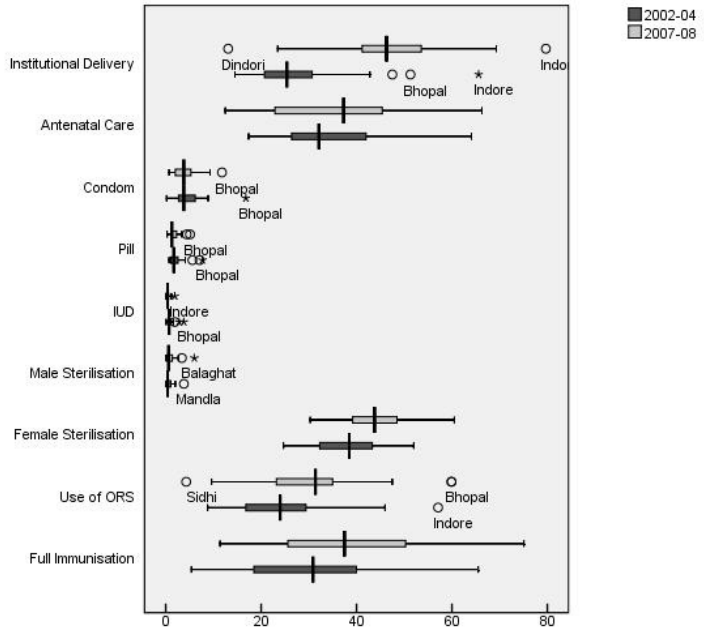
In order to measure the progress in terms of the above five interventions, we have used the following nine indicators for which information is available through 2002-04 and 2007-08 rounds of district level household survey:

1. Proportion of mothers who had at least three antenatal check-up (ANC)
2. Proportion of institutional deliveries (DEL)
3. Proportion of children 12-23 months of age fully immunised (IMM)
4. Prevalence of IUD (IUD)
5. Prevalence of Pill (PIL)
6. Prevalence of Condom (CON)
7. Prevalence of female sterilisation (FST)
8. Prevalence of male sterilisation (MST)
6. Proportion of child used ORS at the time of diarrhoea. (ORS)

Results

Figure 1 shows the inter-district variations in the level of achievement in Madhya Pradesh in terms of the nine variables used in the analysis for the period 2002-04 and 2007-08. It may be seen from the figure that the level of achievement varies widely not only across the districts of the state but also in terms of different indicators used in the analysis. More specifically, achievement remains abysmally poor in case of spacing methods of family planning which, the use of which ensures proper spacing between successive births, a critical intervention for preventing child deaths. It is also clear from the figure that the goal of universalisation of key interventions directed towards improving child survival still remains elusive in all but a few districts of the state.

Figure 1
Inter-district variations in selected indicators related to child survival in Madhya Pradesh



Obviously, there is very substantial scope of scaling up these interventions. There is every likelihood that scaling up of these interventions will contribute to an accelerated reduction in infant and child mortality in the state.

Another discerning feature of the figure 1 is that the improvement in different indicators used in the analysis has not been uniform. Improvement appears to be the maximum in case of institutional deliveries whereas in case of the prevalence of IUD and pill, there has actual been a decrease in the prevalence. On the other hand, there has been virtually no increase in the prevalence of condoms while the prevalence of male sterilisation has increased only marginally between 2002-04 and 2007-08, according to the information available through the district level household survey. Obviously, progress of child survival efforts in the districts of the state has not been uniform.

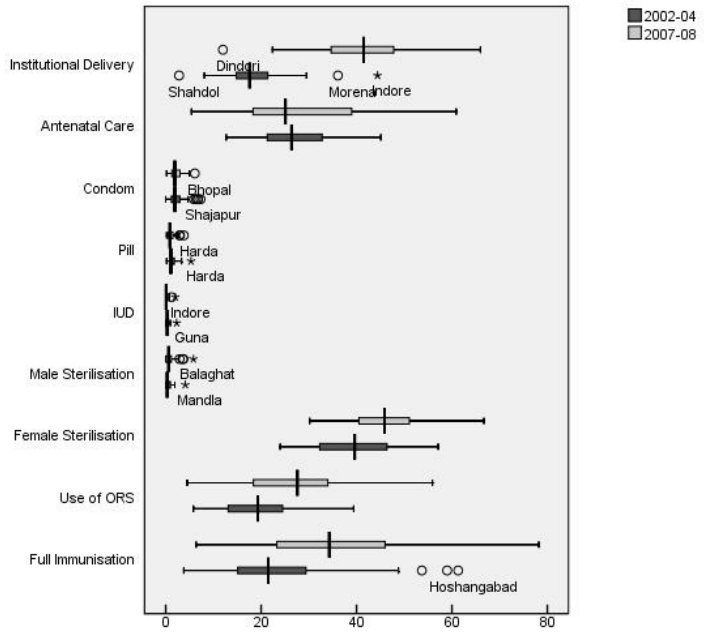
Another important observation of the figure 1 is that with the increase in the level of achievement, the inter-district variability in the

level of achievement has also increased. This means that in some districts, progress of child survival efforts has been relatively faster while other districts appear to have lagged behind because of slower than expected progress. For example, during the period 2002-04, the proportion of institutional deliveries ranged from less than 15 per cent in district Shahdol to almost 66 per cent in district Indore. However, during the period 2007-08, it ranged from just around 13 per cent in district Dindori to almost 80 per cent in district Indore. An increase in the inter-district variability in the performance of other indicators related to child survival may also be seen from figure1. These observations are also supported by the summary measures of inter-district variation in the achievement of selected child survival efforts which are presented in table 1 for the total population and in table 2 for the rural population. Moreover, in case of some of the indicators, the coefficient of variation - an indicator of inter-district inequality in the level of achievement - has increased over time whereas it has decreased in others. This means that in some of the dimensions of child survival, the achievement inequality across the districts of the state has decreased while in other dimensions, it has increased over time. Obviously, progress of child survival efforts in the state has not been uniform across the districts as well as across different indicators.

The district level household survey provides information about selected indicators related to child survival for the rural areas also. Inter-district variations in selected indicators of related to child survival in the rural areas are presented in figure 2. It is clear from the figure that levels, trends and inter-district variations in nine indicators in the rural areas are very much similar to that in the total population. Most importantly, the change in terms of the proportion of women who had at least three antenatal check up during their last pregnancy has been disturbing. The median value of this proportion has decreased but the range and the inter-quartile range has increased over time. As the result, the inter-district inequality in antenatal coverage in the rural areas of the state has increased.

In view of the fact that not only the level but also the improvement in the nine indicators used in the analysis vary widely across the districts, we have made an attempt to combine the indicators by applying the factor analysis procedure. Application of the factor analysis procedure suggests that the nine variables can be grouped into four factors in the total as well as in the rural population. In the total population, the four factors accounted for more than 63 per cent of the

Figure 2
Inter-district variations in selected indicators related to child survival in Madhya Pradesh (Rural)



total variation in the original data set whereas in the rural population, the four factors explained more than 66 per cent of the total variation. The variables having significantly high loadings in each factor are shown in table 3. It may be seen from the table that the factor structure is not the same in the total population and in the rural population, although the difference in the structure is only marginal. In any case, table 3 suggests that the four factors broadly represent the four dimensions of child survival efforts. The first factor is related to efforts focussed on delivery and infancy. This factor essentially reflects the state of institution-based services. The second factor is related to birth spacing which has a direct relevance to child survival and which primarily reflects the progress of extension or community-based services. The third factor, on the other hand, is related to birth limitation which reflects the progress of camp-based services. Finally, the fourth factor is related to the use of oral rehydration therapy to combat deaths due to dehydration during diarrhoea which are basically related to

services available at grass-roots level primary health care institutions - primary health centres and sub-health centres. In any case, the factor analysis solution suggests that child survival efforts are essentially multidimensional. As such, the progress of child survival efforts should be analysed in the context of these four factors.

The factor analysis solution also provided factors scores for each of the 45 districts of the state for each of the four factors extracted through the factor analysis procedure. These factor scores summarise the progress of a district in terms of four dimensions of child survival efforts. These factor scores were than used for ranking the districts in terms of progress in the four factors related to child survival. These rankings are given for the total population in table 4 and for the rural population in table 5. These rankings suggest that progress of child survival efforts in the districts of the state vary widely across the four dimensions of child survival efforts. There is no district where the progress has been the best in all the four dimensions of child survival efforts. Similarly, there is no district where the progress has been the poorest in all the four dimensions. This shows that the progress of child survival efforts in all the districts of the state has essentially been lop-sided. Very good progress in one dimension has been associated with poor to very poor progress in other dimension of child survival in most of the districts of the state.

Since the four factors extracted through the application of the factor analysis procedure are mutually independent, a straightforward approach of developing a composite index of progress of child survival is to take the simple average of the score of each of the four factors. On the basis of this average score the districts of the state can be classified into five categories - very good progress, good progress, average progress, poor progress and very poor progress - on the basis of the rank of the district in terms of the average score. This exercise has been carried out for the total as well as the rural population. This analysis suggests that in 16 districts of the state the progress of child survival efforts in the total and in the rural population has virtually been the same (Table 5). Among these districts, the poorest performing districts are Dindori, Guna, Morena, Rajgarh and Sheopur. On the other hand in progress of child survival efforts has been very good in West Nimar, Ujjain and Dewas districts. In Sehore district also, the progress has been good whereas in Mandla and Umaria districts the progress has been poor. On the other hand, in Jabalpur and Raisen districts, the progress may be termed as average. In other districts of the state, the progress of

child survival efforts has been different in total and rural population. In 14 districts of the state, the progress has been relatively better in the rural population as compared to the total population whereas in the remaining 18 districts, the progress has been relatively poor in the rural population as compared to the total population.

The foregoing analysis suggests that the progress of child survival efforts in the districts of the state has varied widely. This variability in the progress appears to be a reflection of the lack of comprehensiveness and complementarity in child survival efforts It appears that this lack of comprehensiveness and complementarity may be one of the reasons for relatively slow transition in infant and child mortality in most of the districts of the state and even an increase in the risk of death during childhood in some of the districts. Reasons behind this lop-sidedness of child survival efforts in most of the districts of the state are not known at present. However, it appears obvious that these efforts lack objective planning, result-based management of child survival interventions and objective monitoring and evaluation. There is near total lack of information about child survival, its differentials and determinants at the district level. Similarly, there is virtually no information about causes of infant and child deaths and how the causes of death pattern varies across the districts. Planning and execution of child survival efforts is virtually normative in terms of contexts and contents and the local context of infant and child mortality is sadly missing in this planning and implementation process. Similarly, there is no comprehensive yet objective system of monitoring and evaluation of child survival efforts at the district level. The only information available at the district level is the provider-based information about services delivered. These programme service statistics are known for a number of errors and are grossly inadequate for objective assessment of child survival efforts.

Conclusions

Information available through the district level household survey makes it possible for the first time to have an objective assessment of the progress of child survival efforts at the district level in Madhya Pradesh. This assessment suggests that the progress of these efforts is at best lop-sided in most if not all the districts of the state. This lop-sidedness appears to be one of the reasons for relatively slow transition in infant and child mortality in the state. It appears that child survival efforts in the state lack need-based planning, efficient implementation and

objective monitoring and evaluation. One reason for such a situation appears to be a near total absence of evidence and understanding about different social, economic, environmental and cultural factors of infant and child mortality in the state, especially at lower tiers of administration. At present, there is no objective, yet transparent system of assessing the progress of child survival efforts at the district level. The district level household survey has been able to fill up this void only to a limited extent. For example information available through the district level household survey does not permit an assessment of the progress across different social groups as it is well known that infant and child mortality varies widely across social groups even within the district. Institutionalising an objective evidence-based system of assessing the progress of child survival efforts may go a long way in effective implementation and scaling up of child survival efforts in the state which are critical for hastening the pace of improvement in child survival.

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Table 1
Summary measures of indicators of child survival efforts in Madhya Pradesh - Total Population

	IMM	ORS	FST	MST	IUD	PIL	CON	ANC	DEL
					2007-08				
Minimum	11.4	4.3	30.3	0.0	0.0	0.3	0.7	12.5	13.1
Q_1	25.6	23.2	39.2	0.3	0.2	1.1	2.0	22.9	41.2
Median	37.5	31.4	43.8	0.6	0.4	1.3	3.8	37.3	46.3
Q_3	50.3	35.0	48.5	1.4	0.6	2.3	5.3	45.4	53.6
Maximum	75.1	59.9	60.5	6.0	1.9	5.1	11.8	66.3	79.7
IQR	24.7	11.8	9.3	1.1	0.4	1.2	3.3	22.5	12.4
Mean	38.2	30.3	44.6	1.0	0.5	1.7	4.1	36.0	47.8
SD	16.3	11.7	6.8	1.1	0.4	1.1	2.5	15.8	12.8
CV	0.426	0.385	0.152	1.132	0.774	0.616	0.605	0.438	0.27
					2002-04				
Minimum	5.4	8.8	24.7	0.0	0.1	0.7	0.2	17.4	14.5
Q_1	18.5	16.8	32.3	0.2	0.5	1.1	2.7	26.4	20.7
Median	30.9	24.0	38.5	0.4	0.7	1.7	3.8	32.1	25.4
Q_3	40.0	29.4	43.3	1.1	1.0	2.6	6.2	42.0	30.7
Maximum	65.5	57.1	52.0	3.8	3.8	7.7	16.8	64.1	65.6
IQR	21.5	12.6	11.0	0.9	0.5	1.5	3.5	15.6	10.0
Mean	30.4	24.1	38.0	0.8	0.9	2.2	4.6	34.3	27.2
SD	13.8	9.7	7.4	0.7	0.6	1.5	2.9	11.0	10.1
CV	0.453	0.403	0.194	0.965	0.744	0.690	0.639	0.322	0.37

Q_1 = First quartile
Q_3 = Third quartile
IQR = Inter quartile range
SD = Standard deviation
CV = Coefficient of variation

Table 2
Summary measures of indicators of child survival efforts
in Madhya Pradesh - Rural Population

	IMM	ORS	FST	MST	IUD	PIL	CON	ANC	DEL
					2007-08				
Minimum	6.4	4.5	30.2	0.0	0.0	0.2	0.2	5.4	12.0
Q_1	23.3	18.4	40.5	0.1	0.0	0.6	1.3	18.3	34.7
Median	34.3	27.6	45.9	0.6	0.1	0.9	1.9	25.1	41.5
Q_3	46.0	34.0	51.1	1.2	0.4	1.5	3.0	39.0	47.8
Maximum	78.2	55.9	66.7	5.8	2.0	3.8	6.1	60.9	66.0
IQR	22.7	15.6	10.6	1.1	0.4	0.9	1.7	20.7	13.1
Mean	35.0	26.8	46.4	1.0	0.3	1.2	2.3	29.4	41.8
SD	15.7	11.8	7.8	1.2	0.4	0.8	1.4	13.8	11.2
CV	0.449	0.439	0.168	1.213	1.405	0.704	0.625	0.467	0.27
					2002-04				
Minimum	3.8	5.8	24.0	0.0	0.0	0.2	0.0	12.7	2.8
Q_1	15.1	13.1	32.3	0.1	0.2	0.8	1.2	21.3	14.8
Median	21.5	19.3	39.6	0.3	0.3	1.1	1.9	26.4	17.6
Q_3	29.4	24.5	46.4	1.0	0.6	1.8	3.0	32.8	21.4
Maximum	61.3	39.4	57.1	4.1	2.3	5.3	7.3	45.1	44.4
IQR	14.3	11.4	14.1	0.9	0.4	1.0	1.8	11.5	6.6
Mean	24.2	19.6	39.1	0.6	0.4	1.4	2.5	27.7	18.4
SD	13.6	8.3	8.4	0.8	0.4	0.9	1.8	8.8	7.0
CV	0.560	0.424	0.215	1.205	0.918	0.672	0.727	0.316	0.378

Table 3
Factor structure in total and rural population

Factor	Total population	Rural population
I	• Proportion of children 12-23 months fully immunised • Proportion of women received at least 3 antenatal check up • Proportion of institutional deliveries	• Proportion of children 12-23 months fully immunised • Proportion of women received at least 3 antenatal check up • Proportion of institutional deliveries
II	• Prevalence of IUD • Prevalence of Pill • Prevalence of Condom	• Prevalence of Pill • Prevalence of Condom
III	• Prevalence of female sterilisation • Prevalence of male sterilisation	• Prevalence of female sterilisation • Prevalence of IUD
IV	• Use of ORS during diarrhoea	• Use of ORS during diarrhoea • Prevalence of male sterilisation

Table 4
Ranking of districts in terms of factor scores in four dimensions of progress of child survival efforts and in terms of average factors score

District	Total population					Rural population				
	I	II	III	IV	C	I	II	III	IV	C
Balaghat	1	19	33	45	23	2	15	4	45	10
Betul	6	36	15	20	12	9	23	41	35	32
Bhind	15	2	8	22	4	25	2	30	24	13
Bhopal	16	45	44	5	42	12	1	36	9	4
Chhatarpur	11	17	13	19	10	21	33	31	22	33
Chhindwara	28	21	35	9	25	29	24	21	10	15
Datia	25	16	10	3	7	23	18	34	3	12
Dewas	4	7	6	40	9	6	11	9	31	6
Dhar	29	26	19	24	21	27	28	33	27	35
East Nimar	38	34	9	7	19	32	4	13	6	5
Guna	27	44	7	25	41	28	22	45	41	45
Gwalior	37	20	29	10	22	20	6	17	13	7
Indore	14	3	45	11	37	22	12	1	12	1
Jhabua	21	29	5	2	3	18	30	28	2	14
Narsimhapur	22	18	37	16	24	26	36	20	17	29
Raisen	31	13	30	30	27	30	20	14	25	19
Sagar	36	43	1	27	31	35	38	42	18	39
Satna	8	12	11	18	5	8	16	35	33	20
Sehore	5	27	12	34	13	5	10	39	21	11
Seoni	32	25	18	21	20	36	32	25	16	31
Sidhi	43	24	39	44	45	37	9	2	44	26
Ujjain	2	32	40	1	2	1	40	15	1	2
Vidisha	10	8	21	13	6	17	31	29	14	22
Barwani	44	9	41	17	36	44	35	3	8	27
Damoh	34	15	4	14	11	41	14	44	23	41
Dindori	45	23	16	33	38	45	13	32	38	42
Harda	24	6	42	6	15	31	42	7	15	25
Hoshangabad	20	28	27	43	40	15	34	8	43	36
Jabalpur	23	33	28	28	26	13	26	27	28	23
Katni	26	40	3	32	28	19	7	43	26	17
Mandla	41	5	36	15	29	42	39	5	11	34
Mandsaur	9	39	34	31	35	11	43	38	29	40
Morena	42	4	25	42	39	43	5	16	42	38
Neemuch	17	22	32	37	32	10	19	10	40	16

District	Total population					Rural population				
	I	II	III	IV	C	I	II	III	IV	C
Panna	30	14	2	12	8	33	17	40	5	18
Rajgarh	33	41	43	36	43	38	45	19	36	44
Ratlam	13	31	17	26	17	14	37	37	34	37
Rewa	18	38	24	8	18	16	27	11	7	9
Shahdol	12	37	20	41	34	7	29	12	39	21
Shajapur	7	35	31	39	30	3	44	18	30	24
Sheopur	40	42	38	38	44	39	41	24	37	43
Shivpuri	35	1	22	29	16	34	8	6	20	8
Tikamgarh	19	10	14	35	14	24	25	22	32	30
Umaria	39	30	26	23	33	40	21	23	19	28
West Nimar	3	11	23	4	1	4	3	26	4	3

Table 5
Progress of child survival efforts in districts of Madhya Pradesh.

Total population	Rural population				
	Very poor	Poor	Average	Good	Very Good
Very poor	Morena Dindori Rajgarh Guna Sheopur	Hoshangabad	Sidhi		Indore Bhopal
Poor	Sagar Mandsaur	Mandla Umaria	Shajapur Shahdol Barwani	Katni Neemuch	
Average	East Nimar	Seoni Dhar Narsimhapur	Jabalpur Raisen	Balaghat Chhindwara	Gwalior
Good	Damoh Ratlam	Chhatarpur Betul Tikamgarh	Harda	Sehore	Shivpuri Rewa
Very good		Chhatarpur	Satna Vidisha	Jhabua Bhind Datia Panna	West Nimar Ujjain Dewas

Child Survival and Health Among the Urban Poor in Madhya Pradesh

Siddarth Agarwal
Aradhana Srivastav

Introduction

Madhya Pradesh is the home of about 18 million urban population around 2008 according to population projections prepared by the National Population Commission (Government of India 2006) and accounts for more than one fourth (27 per cent) of its total population. The urban population in the state grew by 31 per cent during the decade, 1991-2001, while the total population grew by 24 per cent (Government of India 2001). It is estimated that the urban population of Madhya Pradesh will rapidly increase to 40.4 million comprising one third of the state population by the year 2026.

Madhya Pradesh is also a state with high proportion of urban poverty. It is estimated that 42.1 per cent of the urban population of the state, comprising 7.4 million people, is poor (Government of India 2007). This proportion is much higher than the national average of 25.7 per cent. The proportion of urban population below the poverty line in the state is the second highest in the country, next only to Orissa. Further, urban poverty in the state is marginally higher than the rural poverty which is estimated to be 37 per cent. Healthcare for the urban poor is, therefore, a key priority as the number of the urban poor increases rapidly with the increasing urbanisation.

The urban poor are vulnerable to many health risks as a consequence of living in conditions characterised by cramped, low-quality housing with limited sanitation, limited access to affordable quality health care, widespread illiteracy, social isolation, and a lack of

negotiating capacity to demand improved public services. Studies across the world have shown a trend of higher malnutrition, childhood illness and mortality in urban slums as compared to non-slum environment (Agarwal and Taneja 2005).

Children of the urban poor, living in slum environment, suffer accentuated vulnerability to outbreaks of diseases such as diarrhoea, measles, jaundice and typhoid, owing to high population density and continuous influx of new pool of infective agents with immigrating population (Agarwal, Bhanot and Goindi 2005, Awasthi and Agarwal 2003). Most of these diseases are preventable through relatively simple hygiene behaviour and through complete immunisation of infants.

Madhya Pradesh has the highest IMR in the country (74 per thousand, much higher than national average of 57, as per 2006 estimates (Government of India 2007). Several child survival and newborn health care schemes are in progress in the state to address high infant mortality. In this paper, we analyse the impact of these schemes on the health and survival of urban poor children who constitute a high-risk population. It is difficult for the state to achieve the goal of reduction in infant mortality as described in the XI Five-year Development Plan without addressing the needs of the urban poor.

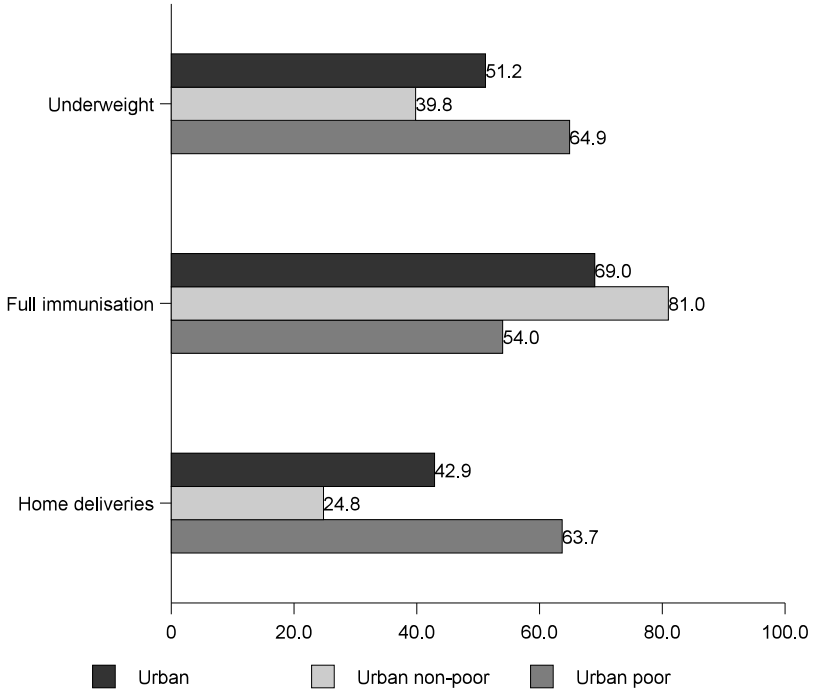
Child Health Status among Urban Poor

Madhya Pradesh has some of the most alarming child health indicators in India. Health indicators of the urban poor in the state are even worse than national averages and are very similar to those in rural population. In order to unravel the existing intra-urban disparities, data from NFHS-3 were re-analysed by the Urban Health Resource Centre. The Wealth Index, an asset based indicator was used to identify the urban poor households. Households with the lowest Wealth Index quartile were classified as poor. Key findings of the analysis are discussed below.

Place of Delivery. Nearly 64 per cent of the urban poor births in Madhya Pradesh took place at home compared to 25 per cent among the non-poor. If not attended by skilled professionals or not adhering to safe delivery practices, these births pose maximum risk to survival of mothers and infants.

Immunisation. Immunisation coverage among urban poor children was only 54 per cent compared to 81 per cent among the urban non-poor. Urban poor children are difficult to reach on account of residence in slums, migrant status or culturally-influenced resistance.

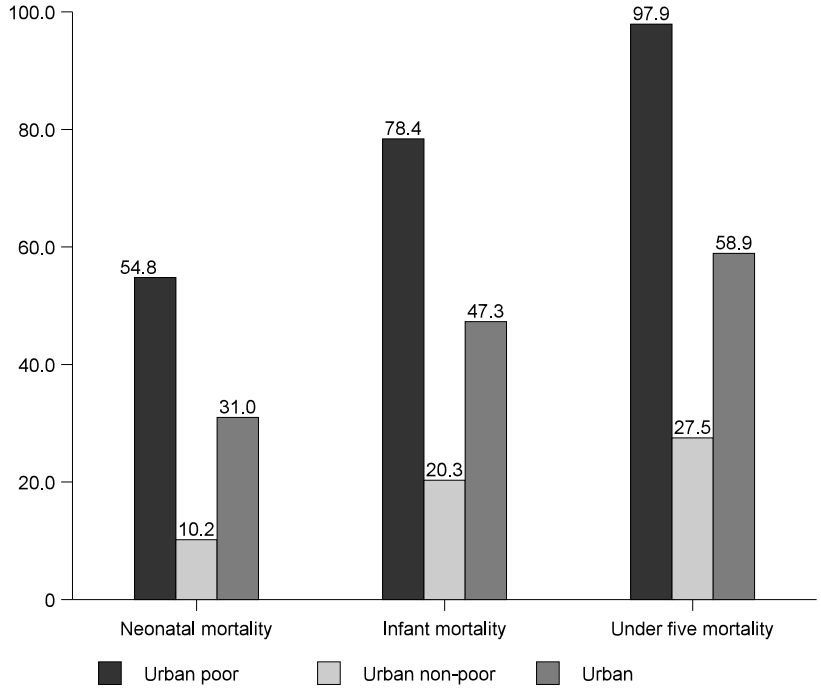
Figure 1
Poor and non-poor difference in coverage of services in urban areas of Madhya Pradesh



Under Nutrition. About 65 per cent of urban poor children in Madhya Pradesh are underweight, much higher than non-poor children (40 per cent). Malnutrition among urban poor children is caused by inadequate or improper food intake due to poverty compounded by repeated episodes of parasitic and other childhood diseases such as diarrhoea as a result of poor sanitation and hygiene and improper care during illness (Ruzicka and Kane 1985, Pelletier et al 1995).

Neonatal, Infant and Child Mortality. Limited access to health care services, lack of adequate nutrition, inadequate sanitation and poor hygiene among the urban poor result in high infant and child mortality which is considerably higher among the urban poor compared to urban non-poor. As seen from figure 4, an alarming 98 new born per 1000 live births do not survive to their fifth birth day in the urban slums of the state. This proportion is substantially higher than the national under-five mortality rate of 73 under-five deaths per 1000 live births in India.

Figure 2
Neonatal, infant and under five mortality in poor and non-poor in urban areas of Madhya Pradesh



Factors affecting Child Health among Urban Poor in Madhya Pradesh

Debilitating environmental conditions, high population density and poor hygiene behaviour expedite disease transmission among slum dwellers in the urban areas, while irregular and insufficient food intake contributes to under nutrition of children. All these factors, together, adversely affect survival and health of children and impede their normal growth and development. Factors affecting survival and health of children can be classified into three categories - those which arise from the community; those related to access to healthcare services; and those relating to the environmental conditions of slums. These factors are discussed at some length in the following pages in the context of Madhya Pradesh.

Community level Factors

Poverty/Vulnerability Pockets. Poverty is the major underlying cause of a number of aspects which further affect the survival and health status of children in slums of the urban areas. These include, among others, type of housing, level and regularity of food intake and affordability of such services like immunisation against vaccine preventable diseases and basic healthcare services all of which ultimately bear upon child health. A section of the urban poor also suffer greater vulnerability because of migratory status (seasonal migrants), type of occupation (scavenging) or environmental conditions (living within factory premises). They are often left out of even existing efforts such as immunisation drives or community counselling on feeding.

Livelihood and Housing Insecurity. Most slums and urban poor habitations are encroachments on public or private land. Unauthorised occupations are not served by any civic amenities, which affect the quality of life of the residents and make them more prone to infections. Livelihood insecurity affects the food intake of poor families. The compulsion for wage earning also forces women to resume wage labour soon after delivery, leaving the newborn often in the neglect.

Poor Health and Hygiene Behaviour. Urban slum environment poses a huge challenge to human health in terms of poor hygiene conditions. Relatively simple but essential hygiene behaviours such as good hand washing practices can save a substantial number of disease episodes and deaths due to diarrhoeal diseases among the urban poor. Similarly maintaining safe and hygienic delivery practices can also bring down the maternal and neonatal mortality associated with home deliveries. Such behaviour is, however, sub-optimal among the urban poor on account of ignorance as well as culturally influenced misconceptions, which accentuate the burden of maternal, neonatal and child morbidity and mortality among them.

Poor Demand and Weak Negotiating Capacity of the Community. Residents of slums have limited knowledge on appropriate health behaviours and they are likely to be unaware of the location and services provided by health facilities, out-reach visits of health workers etc. This results in poor demand and utilisation of health services Slums are also socially excluded communities, often left out of the social fabric and therefore suffer from lack of confidence to express their requirements and very poor negotiating power to demand better services and entitlements.

Poor access to existing child health services

Unlisted Slums. Slums, in the urban areas, generally remain unrecognised for many years owing to delay in updating of the slum list. Such unlisted slums are usually not covered by such essential services like water supply and sanitation. They are also not covered by public health services and are left out of routine outreach programmes such as immunisation camps. It has been found that in the Indore city, immunisation services against vaccine preventable diseases scarcely reached those slums which were not notified while notified slums received all the benefits of repeated interventions (Agarwal and Taneja 2005). When basic infrastructure and services are lacking, urban settlements are amongst the world's most life threatening environment (WHO 1999).

Inadequate and Ineffective Public Health Services. Slums and squatter settlements are poorly covered by primary health care services. These facilities have not grown in proportion to the explosive growth of urban population especially the urban poor. Even the available facilities may not be in the physical proximity to urban slum clusters. One primary health care facility in an urban area caters to a much higher population compared to the norm of 1 centre for every 50,000 population (Shekar and Ram 2005). Though health facilities in the private sector have a wide presence in urban areas, yet, they are often not accessible to the poor because of the high cost. The poor are therefore forced to fall back on the unqualified private providers who provide poor quality services. Moreover, these informal providers do not provide preventive health services such as immunisation, antenatal care, and counselling on proper child care and nutrition, as these services do not generate any profit. Other problems related to primary healthcare services in slum areas include unsuitable timings, inadequate staffing, unfriendly behaviour towards poor patients and high staff absenteeism.

Poor Service Coverage and Pockets of Exclusion. Some slums are situated on the border of two urban health centres, with neither taking responsibility of inhabitants of these slums. Health centres are often located at large distance from their slum catchments, making it difficult for people to access them. Similarly, peri-urban slums are also at a disadvantage as neither rural nor urban health centres take the responsibility of serving them. Even within slums, certain pockets are not served, such as migrants who are highly mobile, are difficult to reach (Agarwal, Bhanot and Goindi 2005).

Environmental Conditions

Slums are mostly informal settlements and usually illegal in status. These settlements are not served by civic amenities of any kind. Their situation is worse if they are located near nallahs, river banks, on low-lying lands, steep slopes, near railway lines or at peri-urban locations. Such environmental factors are conducive to collection of waste and transmission of infectious pathogens. Outbreaks of diseases such as cholera, diarrhoea, jaundice and typhoid are common in such environments. Moreover, the overcrowding in slums results in prolonged exposure to infections and greater severity of infections in such cases (Lodha 2000). Slums are therefore ideal breeding grounds for infectious diseases and the worst victims of these maladies are children.

Strategies for Addressing Child Health Challenges among Urban Poor

Several approaches have been used to target neonatal and child health among the urban poor through government programmes and through civil society initiatives. This section examines main approaches and highlights their effectiveness.

Breastfeeding. Breast milk provides optimal nutrition and promotes child's growth and development; it is associated with improved growth during the first months of life. Initiation of breastfeeding immediately after birth or within an hour of birth is essential for good health of the newborn. Nutrients in the breast milk, especially essential fatty acids, increase immunity leading to reduced infant morbidity, and help build closer mother-child relations (Walker 2007). Exclusive breast feeding for the first six months of life helps in protecting the newborn and the infant from diseases, reduces the risk of mortality and encourages healthy child development (UNICEF 2009). Activities promoting early and exclusive breastfeeding target behaviour change, and, therefore, often make a difficult progress. NFHS-3 data show that early and exclusive breastfeeding is currently practised by less than one fifth of urban poor women, and only about 28-29 per cent of non-poor women. This shows low adherence to recommended breastfeeding practices, possibly under influence of traditional wisdom. In spite of the slow progress associated with behaviour promotion efforts, it is absolutely essential to target breastfeeding as one of the most crucial interventions for influencing child health, nutrition and survival.

Behaviour Promotion. A wide range of favourable behaviours influencing newborn and child health can be targeted under behaviour promotion strategies. The RCH-II has focussed on a range of behaviours which influence infant and child health under its BCC strategy. These include newborn care practices (recognition of danger signs, proper cleaning, warming and feeding of the baby, early and exclusive breast feeding), immunisation, management of sick child (recognition of ARI/diarrhoea symptoms and timely treatment including use of ORS for treating diarrhoea). Evidence from research has shown that washing hands with soap can reduce the risk of diarrhoeal diseases by 42–47 per cent (Curtis and Cairncross 2003). Good hand-washing practices have also been shown to reduce the incidence of other diseases, notably pneumonia, trachoma, scabies, skin and eye infections and diarrhoea-related diseases like cholera and dysentery (UNICEF 2008).

Timely Immunisation. The urban poor areas are marked by higher incidence of vaccine preventable diseases such as measles and diphtheria, which are highly contagious. However, reach of immunisation services among the urban poor is weak on account of gaps in coverage, resistance of families against immunisation due to traditional beliefs, low birth registration leading to non-targeting of eligible children and mobility of communities. Higher immunisation dropout rates in the urban areas highlight the fact that though physical reach/access may be easier in urban areas, regular outreach sessions, follow-up and consistent quality of services need definitive action. Immunisation outreach is a significant component of urban RCH-II. Increasing coverage of children through immunisation camps and follow-up through community-based health volunteers (as seen in the Indore urban health programme) have proven to be successful strategies and should be replicated for wider benefit.

Diarrhoea Prevention. Diarrhoea is the second most important killer of children below five years of age world wide following Acute Respiratory Infections (Urban Health Resource Centre 2006). Promotion of basic hand washing behaviour, such as washing hands with soap after defecation, before feeding and before preparing food helps reduce the prevalence of diarrhoea significantly. Oral Rehydration Therapy (ORT) can prevent about 90 per cent child deaths from diarrhoeal dehydration. Knowledge and use of ORS is low among the urban poor and needs to be focussed as a key priority under behaviour change communication activities, especially since diarrhoea prevalence is so high among children in urban poor communities.

Conclusions

The analysis presented in this paper clearly brings out the dichotomy that exists between poor and the non-poor children in the urban areas. High under-nourishment, high morbidity, ineffective health services along with poverty form a vicious cycle which adversely affect neonatal and child survival among urban poor communities. Improving the health of the urban poor is necessary to achieve the goals set out in the national development policies and Millennium Development Goals (MDGs), especially MDG 4 (reduction in child mortality by three fourth between 1990 and 2015).) Efforts in this direction should ensure:

1. Adapting to city-specific situations through city-specific urban health planning and implementation. This is already being implemented in Indore, Bhopal and Jabalpur, and is expected to be scaled up to more cities once National Urban Health Mission is launched.
2. Involving communities as equal partners in ushering change. Experience of NGOs as well as government run programs have shown that training slum based health volunteers or Community Based Organizations (CBOs) can be an important strategy for improving health of the urban poor. The can help in strengthening the demand as well as supply of healthcare and help build linkages between the two aspects.
3. Scaling up effective approaches for maximum coverage. Successful strategies being implemented on a limited scale in cities can be scaled up for greater impact. Similarly approaches can be replicated in other cities as well to maximize coverage of urban poor communities across the state.

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Infant Mortality, Fertility and Family Size: A District Level Analysis

SRJ Singh

Introduction

An investigation into the association between infant mortality and fertility has long been of great demographic, social and economic significance especially in the developing countries where population growth rate continues to be high. The demographic transition theory presumes that the long run decline in mortality sets into motion forces that eventually lead to a decline in fertility. In India, infant mortality still continues to be quite high and, it is argued that, high infant mortality is an obstacle in accelerating the decline in fertility. A study of fertility decline in the context of varying levels of infant mortality would, therefore, reinforce our ideas to understand the phenomenon of fertility transition. Several studies dealing with the role of socio-economic and demographic variables affecting fertility in relation to the varying levels of infant mortality have emerged out of research findings (Barmal et al 1982)

The aim of this paper is to analyse the relationship between fertility and infant mortality in the rural population of district Rewa in Madhya Pradesh. Available evidence suggests that mortality, especially infant mortality, has declined considerably during the last twenty years in the rural areas of district Rewa, although, infant mortality in the district is still very high compared to state and national averages. On the other hand, fertility rates in the district remain consistently at a high level so that the population of the district may be classified as a population in the early stages of demographic transition. It is in this context, it is

relevant to investigate the effect of infant mortality on the fertility in the rural population of the district. The child replacement hypothesis argues that couples who lose their child during infancy are expected to make up the loss by having more births which keeps fertility high. Incidently, the child replacement hypothesis is relevant only in the context of deliberate efforts to control fertility. Otherwise, couples would continue to bear children until one of the spouses becomes permanently sterile, or dies. Any evidence of the 'replacement' effect operating in the rural population would therefore suggest the existence of some indirect control of fertility.

Data

The present paper is based on the information available through Demographic Survey of Rewa (Rural), Madhya Pradesh which was carried out in the year 2003. During the survey, information on various aspects relating to household structure, household facilities, fertility, mortality, migration, etc, was collected from about 442 households, selected from 14 villages in the Rewa sub-district of district Rewa following a two stage stratified random sampling procedure. For the sake of convenience, only villages situated at a distance of 15 kms or less from Rewa city, the headquarters of district Rewa and sub-district Rewa were considered as the population universe. In each of the selected villages, a listing of all the households was carried out and a random sample of 30 household was taken from each of the selected villages. Information from the selected households was collected on the basis of a pre-designed and pre-tested questionnaire through personal interview method.

Results

Information available through the survey suggests that individual experience of child loss (infant deaths) has some effect on fertility, that is attributed to replacement effect. Table 1 presents average number of children ever born to eligible couples by the age of the mother and different levels of infant deaths. It is clear that as number of infant deaths increases, the average number of children ever born to females also increases. Findings of several other studies (Taylor et al 1976, Singh and Berman 1975, Westoff 1974, Heer and Smith 1968) also suggest that reduction of infant and child mortality is one of the necessary precondition for the reduction in fertility and acceptance of the small family norm.

Table 2 presents the average number of surviving children to eligible couples according to number of infant deaths and the current age of the mother. It is evident from the table at the end of reproductive period, the number of infant deaths does not affect the average number of surviving children substantially.

To see the simultaneous effect of infant mortality and the age at the consummation of marriage on fertility, we divided each group into two parts according to the age of the woman at the consummation of her marriage. In group I, we include all those women whose age at the consummation of marriage was less than or equal to 14 years and in group II, we included all those women whose age at the consummation of marriage was between 15 to 19 years. The average number of children ever born by the number of infant death and the current age of the mother are shown in Table 3.

An examination of Table 3 reveals that the average number of children born to eligible couple is more in group I in comparison to group II irrespective of the number of infant deaths. From this, we conclude that if the consummation of marriage is delayed, the average number of births per woman decreases irrespective of the number of infant deaths.

Conclusions

Similar to the findings of earlier studies, in the present analysis too, we observe that in the rural population of district Rewa, the higher is the infant mortality, the higher is the fertility.

The analysis also indicates that a decrease in infant mortality contributes to lowering fertility. As such, the same number of births would result in more children surviving at any given age and there may be greater demand of fertility control through contraception. Besides, the presence of an infant or young child and the strain of child rearing may reduce the frequency of sexual intercourse and hence low fertility.

The influence of infant and child mortality on fertility is not an instantaneous adjustment process. In the long run of demographic transition, fertility decline normally lags mortality decline as well as infant mortality decline. However, the time span of fertility decline and the time span of mortality decline varies considerably from one context to another. If, in a given set of circumstances, it is possible that reduction in infant mortality induces a fall in fertility, then an understanding of the factors affecting the lag become highly pertinent.

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Table 1
Distribution of average number of children ever born according to number of infant deaths and present age of women

Present age of	Infant deaths			
Women	0	1	2	3+
<15	0.00(8)	-	-	-
15 -- 19	0.33(63)	0.41(5)	-	2.00(1)
20 - 24	1.43(72)	1.60 (18)	2.76(4)	3.00(2)
25 - 29	2.88(46)	3.95 (22)	3.61(8)	4.46(4)
30 - 34	3.14(26)	4.17 (21)	4.74(10)	5.33(5)
35 - 39	4.00(22)	4.19 (18)	5.45(8)	5.89(8)
40 - 44	4.82(15)	5.40 (10)	6.22(9)	6.07(7)
45 - 49	5.06(9)	6.16(9)	6.52(4)	6.08(4)

Note Figures in parentheses refer to number of observations.

Table 2
Distribution of average number of children alive according to number of infant deaths and present age of wife

Present age of	Infant deaths			
Women	0	1	2	3+
<15	0.00(8)	-	-	-
15 -- 19	0.30(63)	0.45(5)	-	0.00(1)
20 - 24	0.34(72)	1.54(18)	0.48(4)	0.91(2)
25 - 29	1.59(46)	1.61(22)	2.03(8)	1.85(4)
30 - 34	2.54(26)	2.77(21)	2.19(10)	2.33(5)
35 - 39	3.04(22)	3.66(18)	3.98(8)	2.79(8)
40 - 44	3.34(15)	4.47(10)	4.55(9)	3.47(7)
45 - 49	4.03(9)	4.81(9)	4.62(4)	4.52(4)

Note Figures in parentheses refer to number of observations.

Table 3
Distribution of average number of children ever born according to mother's age and number of infant deaths considering the age at consummation of marriage

Present age of Women	Infant deaths							
	0		1		2		3+	
	14	15-19	14	15-19	14	15-19	14	15-19
<15	0.00 (8)	-	-	-	-	-	-	-
15 -- 19	0.50 (24)	0.22 (39)	1.57 (3)	1.15 (2)	-	-	-	2.00 (1)
20 - 24	1.96 (19)	1.32 (53)	1.95 (7)	1.45 (11)	1.80 (1)	1.32 (3)	2.25 (1)	2.00 (1)
25 - 29	3.32 (16)	2.87 (30)	3.30 (8)	2.87 (14)	3.03 (4)	3.33 (4)	3.91 (1)	3.25 (3)
30 - 34	3.96 (9)	3.12 (17)	4.53 (8)	4.09 (13)	4.02 (5)	3.64 (5)	5.73 (2)	4.25 (3)
35 - 39	4.85 (8)	3.86 (14)	4.45 (6)	5.10 (12)	4.56 (2)	4.51 (6)	6.25 (3)	5.66 (5)
40 - 44	4.93 (5)	4.62 (10)	5.96 (3)	4.02 (7)	5.48 (4)	5.33 (5)	6.64 (3)	6.76 (4)
45 - 49	4.76 (2)	5.45 (5)	6.24 (3)	6.00 (6)	6.46 (1)	5.12 (3)	6.2 (2)	5.44 (2)

Note Figures in parentheses refer to number of observations.

Determinants of Birth Weight and Early Neonatal Mortality

NK Tyagi

Introduction

All over the World, major changes are taking place in the area of maternal and child health to achieve the goals set out in international declarations and country wise commitments. The need for information and evaluation has, therefore, become increasingly apparent.

The causes and determinants of neonatal deaths and still births differ from those causing and contributing to post neonatal and child deaths. Neonatal deaths and still births largely stem from poor maternal health, inadequate care during pregnancy, inappropriate management of complications during pregnancy and at the time of delivery, poor hygiene practices during delivery, the first few critical hours after birth, and lack of newborn care. Several factors such as women's status in the society, their nutritional status at the time of conception, early child bearing, too many closely spaced pregnancies etc. are deeply rooted in the cultural fabric of the society, and their interactions are not clearly understood (WHO 2006, Salilu, Williams and Emusu 2005, Pastore and Williams 2004).

Birth weight is an extremely powerful predictor of the survival of the newborn. In general, the lower is the weight of the baby at birth, the higher is the risk of death during infancy so that the mean birth weight is strongly correlated with the infant mortality (Arifen et al 2000, Forssas et al 1999).

Collins and David (1990), in their study, have observed that low birth weight is caused by either pre-term delivery or fetal growth

retardation. Thus, birth weight provides an opportunity for interventions to improve infant survival and further growth and development of the child.

The low weight of the baby at birth is largely due to the parents' socio-economic-cultural and genetic make-up. Further, health of the mother during her childhood and during pregnancy contributes significantly to the intrauterine growth of the newborn (Hediger et al. 1995, Wilcox 1981).

Wilcox and Russell (1983) observed that perinatal mortality was closely related to weight at birth. Their analysis has established that the distribution of weight at birth is essentially Guassian with additional births at lower ends that divides the distribution in two components; i) a predominant distribution (Guassian) and ii) a residual distribution. Finding shows that predominant distribution is largely of term births, while the residual distribution is almost entirely composed of pre-term births. Further, it was observed that male babies suffer a higher perinatal mortality than female babies, despite being fewer low weight male births.

Barker and Lackland (2003) observed that the birth weight is also associated with health outcomes later in the life. Asthma, low IQ, and hypertension have been reported to be more common among those who were low weight at birth. The usual approach assumes that the weight at birth is the casual pathway to the health of an individual latter in life. Thus, there has been a resurgence of interest in the association between birth weight and diseases of adulthood e.g. cardiovascular diseases, diabetes, certain cancers, and impairment of hearing or vision. It is a fascinating finding that, when weight-specific data are available, the risk of later endpoints often echo the reverse J-shaped curve with infant mortality.

In the present study, an attempt has been made to study the maternal determinants of birth weight and mortality in the early days of life. Suitable models to estimate weight at birth, classification of the newborn with low weight at birth and mortality in early days of life have been established. The ROC curve for low birth weight and early neonatal mortality have been prepared to identify mothers and neonates for necessary care.

Materials and Methods

In the present paper, 27,979 mothers and 35,279 babies delivered at a big rural hospital in central India, during January 1990 through December

2005 formed the study sample. The data on the age of the mother, period of gestation, parity, Haemoglobin level of the mother, duration of hospital stay, causes of maternal death, weight of the newborn, sex of newborn and cause of death of the newborn were retrieved from the hospital records. ANOVA (Analysis of variance) is used to test the difference between means and to uncover main and interaction effects of categorical independent variables (called 'factors') on an interval scale variable. Methodological details of the analysis are given below:

Proportion of Variance explained (Eta^2): Eta^2 is computed to study the proportion of variation explained by the categories of independent variable 'x' in dependent variable 'y' and can be defined as:

Eta^2=Between sum of squares (BSS)/Total sum of squares (TSS)

Eta^2 is the proportion of variation explained by the categories of independent variable 'x'.

Proportion of Variation Unexplained =(TSS-BSS)/TSS

Linearity SS=$TSS\times(Cov(x,y))^2/\{V(x)\times V(y)\}$

Linearity SS has been computed as the variation explained by the linear relationship of independent variable 'x' in dependent variable 'y', so that concerned variable can be used in multivariate analysis.

Deviation from Linearity SS = BSS - Linearity SS

Deviation from linearity SS is the variation explained by the categories but not by the linear relationship of variable 'x' with the dependent variable 'y'.

Significance in ANOVA is tested by F-test using appropriate degrees of freedom (df).

$F(df_1,df_2)$ = Mean between sum of squares (MBSS)/Mean error sum of squares (MESS)

where df_1=(K-1) and df_2=N-K.

Principal component analysis has been used to find latent variables so that the multi collinearity can be avoided in multiple variable analysis/models, and they can be used in developing models to estimate the birth weight and the probabilities of the mothers likely to deliver low weight babies and mortality in early days of life.

To estimate mothers likely to deliver low birth weight babies and the standardised effect of the other maternal variables, the logistic regression model has been used as under:

$$\log_e\{P(Y=Bwt<2000gm)/(1-P(Y=Bwt<2000gm))\}=B_0+B_1X_1+..+B_kX_{k+}\epsilon,$$

Odds Ratio = Exp(B), where B is the regression coefficient.

Since, the intrauterine growth of the baby is determined physiologically by the gestational age, the Cox Proportional Hazard model has been used to study the effect of other covariates standardised for gestation.

Care has been taken while coding categorical data for analysis so that the reference categories for respective categorical variables is with (i) lower standard error (for stability of the estimate), and (ii) least risk to be of low weight at birth if possible. These two conditions imply well defined, standardised and stable odds ratios (OR), and it makes easy to suggest corrective measures to improve the response condition.

For the categorical data, the group size is kept large enough to get the estimate of P(y=1 or y=0), because in the initial solution, regression coefficients are estimated from group specific rates. Further, if P(y=1 or y=0)=0 or 1 then the computing package replaces it by $P^{*}=(Sy+c)/(n+2c)$ for that group, where 'c' takes a fixed value in the range of $0<c \leq 0.5$, hence such situations were avoided if possible.

Correctly classified subjects by the model in the two groups of the response variable, that is sensitivity and specificity of the model, depends on the cut off points selected for the purpose. Usually, the analysis is repeated many times to reach at an appropriate cut off point for balanced sensitivity and specificity. However, the cut off point arrived in this manner may not be relevant for the users of research findings. In such situations, it is advisable to use the co-ordinates of ROC curve at relevant cut off points which also makes it easy to compute Likelihood Ratios (LR) and posterior probabilities if the probability associated with other risk variables is known.

Results

Weight at Birth of Newborn and Age of Mother. Table 1 reveals that the mean birth weight increased from 2494 gm. with SD 463 gms to 2588 gms with SD 512 gms as the age of the mother increased from < 20 years to 30-39 years and, thereafter, a decrease in weight at birth was observed which was found to be statistically significant ($p \leq 0.001$). The proportion of low birth weight babies was the highest (13.8 per cent) in mothers aged 40 years and above, followed by mothers aged <20 years (10.2 per cent, $p = \leq 0.05$). Further, the birth weight was found to be linearly related with the age of the mother ($p \leq 0.001$) but the deviation from linearity has also been found to be significant ($p \leq 0.001$). These findings of linearity and deviation from linearity are contradictory, but statistically speaking this can happen because of the large sample size.

Birth Weight and Parity. Table 2 reveals that the mean birth weight varied from 2540 gms with SD 464gms in primi-para mothers to 2531 gms with SD 519 gms in mothers with parity 4 and above and the differences were statistically highly significant ($p<0.001$). The proportion of low birth weight babies was 9.3 per cent in primi-para mothers which decreased to 7.5 per cent in mothers with parity one but increased in higher party mothers reflecting the classical 'U' type curve. Further, the birth weight was also found to be linearly related with parity ($p \leq 0.001$), and the deviation from linearity was also statistically significant ($p \leq 0.001$).These findings of linearity and deviation from linearity need to be taken into consideration while analysing the birth weight data.

Birth Weight and Haemoglobin. Table 3a reveals that the mean birth weight is directly related to the Haemoglobin level but the mothers with Haemoglobin level <7.0 gms/dl and 7.02-8.9 gms/dl did not show any relationship with birth weight. The low birth weight babies showed a clear cut off point of mother's Haemoglobin level at <9 gms/dl and ≥9 gms/dl with 11 per cent and 8.2 per cent newborn respectively. Table 3b again exhibited the similar linear and nonlinear but significant ($p<0.001$) relationship of birth weight and level of haemoglobin of the mother.

Birth Weight and Period of Gestation. Table 4a reveals that the birth weight increases consistently with increase in the period of gestation - from 1387 gms with SD 553 gms in newborn with the period of gestation 28-29 weeks to 2732 gms with SD 395 gms in newborn with period of gestation ≥40 weeks. The proportion of low birth weight babies was 87 per cent in newborn with period of gestation of 28-29 weeks which decreases consistently to 2.4 per cent in newborn with period of gestation ≥40 weeks. The table 4b, on the other hand, exhibits that around 29 per cent of the variation was explained by the variation in the period of gestation groups, and around 20 per cent their linear relationship, though, here again, the linearity and deviation from linearity were found to be statistically significant ($p<0.001$).

Birth Weight and Day at Discharge. Table 5 shows the relationship of birth weight with the day at discharge from the hospital. Though, the differences in birth weight by the day at discharge were statistically significant but absolute differences cannot be said to be of any clinical importance. However, the SD of the birth weight on first and second day of discharge was the highest which indicates that the newborn who were discharged from the hospital on the first and second day had

extreme birth weight i.e., very low and very high weight at birth. This is confirmed by the fact that the prevalence of low weight was highest in newborn discharged(including death) on the first and second day ($p<0.001$).

Principal Component Analysis. In table 6, rotated principal component matrix for gestational age, birth weight, parity and maternal age is given. The table reveals that almost 72 per cent of the total variation in these four variables could be explained by the two principal components - 36.8 per cent and 34.8 per cent respectively. The first principal component is constituted by gestational age ($r=0.857$) and birth weight ($r=0.855$). This principal component is subject to monitoring and can be improved by better antenatal care. The second principal component is formed by parity ($r=0.831$) and maternal age ($r=0.830$) which cannot be changed during pregnancy.

Regression Model to Estimate Weight at Birth: In table 7, results of the regression model for estimating birth weight on the basis of period of gestation, Haemoglobin level, age of the mother, parity and duration of the stay in the hospital is given. All the predictor variables have significant slope coefficient 'B', although, the coefficient of determination 'R^2' was only 0.212 ($p<0.001$).

Logistic Regression Model to Estimate low Weight Newborn Babies: In table 8, the logistic regression model to estimate low weight babies on the basis of gestational age, duration of stay in the hospital, mother's age, parity and Haemoglobin level is given. The table suggests that regression coefficient of the period of gestation, duration of hospital stay, parity and Haemoglobin level are statistically significant. The Odds Ratio of delivering a low birth weight baby with a period of gestation of 28-29 weeks is found to be 289 times as compared to the baby with a period of gestation of $\geq$40 weeks. This Odds Ratio decreases consistently with the increase in the period of gestation. Similarly, the probability of having a low birth weight baby with a hospital stay of less than two days was 2 to 3 times higher than the probability of a newborn with the duration of stay of 4-5 days. The probability of low birth weight babies again increased when the duration of stay in the hospital was six days and more.

The age of the mother did not show any significant effect on the birth weight. However, primi-para mothers had 1.2 times higher chance of having a low weight baby as compared to mothers with at least parity one. The Odds Ratio of having a low birth weight baby decreased with the increase in the Haemoglobin level.

The model has the sensitivity 91.6 per cent and the specificity of 56.5 per cent. The model was able to correctly classify 88.5 per cent of the low weight babies with cut off probability 0.15.

Early Neonatal Mortality by Sex, and Birth Weight: Table 9 reveals that males had significantly higher probability of neonatal death (1.8 per cent) as compared to females (1.4 per cent) (RR=1.29). The early neonatal mortality was the highest (71.3 per cent) (RR=237.7) in babies with birth weight <1000 gms. It decreases consistently with the increase in the birth weight up to babies with birth weight 3000-3500 gms but increases again thus making a reverse 'J' type curve.

Age specific early neonatal mortality was highest 5.31/1000 (RR=6.4) in babies available at the beginning of the 1st day and 3.22/1000 (RR=3.9) in babies available at the beginning of the 2nd day. The early neonatal mortality decreases consistently up to the 8th day in hospital and thereafter, it increases (as babies with relatively better health were discharged early).

Multivariate Models and Analysis: In table 10a, details of logistic regression model to estimate early neonatal mortality on the basis of age at death, sex and birth weight are given. The slope coefficients 'B' for age at death are in comparison of weight at birth 3000-3500 gm and age at death 7 days and onwards. The Odds Ratio of mortality decreased sharply from 242.4 to 2.1 in newborn discharged from the hospital on the first day as compared to newborn discharged at the sixth day. The Odds Ratio of mortality was as high as 982.5 in newborn with birth weight <1000 gm and decreased consistently to 1.4 in newborn with birth weight 2500-3000 gm and then to 2.5 in babies with birth weight ≥3500 gm with respect to the mortality in newborn with birth weight 3000-3500 gm. The Odds Ratio of mortality in male newborn was 1.7 times that of mortality in newborn females.

The model identified 98.4 per cent of the newborn babies' survival and mortality correctly with sensitivity 60.9 per cent and specificity of 99.0 per cent at 0.15 cut off point. In figure 1, ROC curve for early neonatal mortality of the logistic regression model along with its co-ordinates in table 10b are given, so that the model can be used to estimate early neonatal mortality with different cut off points.

In table 11, the results of the Cox regression model of early neonatal mortality are given. The Relative Risk (RR) of early neonatal mortality in the newborn with birth weight <1000 gms was 327.8 as compared to that in new born with birth weight 3000-3500 gms, and then, RR decreased consistently till the birth weight reached 3500 gms.

Thereafter, mortality increased, making a classical 'U' type curve. The male newborn babies had 1.4 times early neonatal mortality as compared in female newborn babies.

Table 11b reveals that the early neonatal mortality was highest in the first day of life and thereafter, it decreased consistently. In figures 4 and 5, plots of survival function and hazard function at mean of covariates have been given.

Discussion

The weight at birth of newborn babies was least of the babies born to mothers of age <20 years and then it increased consistently up to 30-39 years of maternal age and, thereafter, a decrease in weight at birth was observed $P \leq 0.001$. The low weight babies of weight at birth <2000gm were highest in the maternal age group 40 years and above followed by to mothers of age <20 years; $P \leq 0.05$.

The birth weight of the newborn babies born to primi-para mothers was the least followed by babies born to mothers of parity 4+; the differences were highly significantly $P<0.001$.

The newborn babies with low weight at birth <2000gm were 9.3 per cent in primi-para mothers and then decreased to 7.5 per cent in parity one, and again it increased consistently, making classical 'U' type curve, $P<0.001$.

The mean weight at birth, though, significant at $P<0.001$ increased with increasing Haemoglobin but the mothers with Haemoglobin groups <7.0gm/dl and 7.02-8.9gm/dl did not show any relationship with weight at birth. The weight at birth increased consistently with the period of gestation; from 1387gms with SD 553gms in gestation group 28-29 wks to 2732gms with SD 395gms in gestation group ≥40wks, the differences were highly significant $P<0.001$.

The low weight at birth <2000gms was 87 per cent in the babies born with gestation 28-29 wks and decreased consistently and significantly $P<0.001$ to 2.4 per cent in gestation group ≥40 wks.

Forssas and Gissler (1999) had similar findings that maternal characteristics e.g., age, primi-para parity, high parity, smoking, low socio-economic status, being unmarried and earlier perinatal mortality are the important determinants of low weight at birth and perinatal mortality.

The slope 'B' coefficients of regression model to estimating the weight at birth using gestation, Haemoglobin, age of the mother, parity and hospital stay were statistically significant ($P<0.001$), however, the

coefficient of determination 'R^2' was only 0.212; P<0.001. The histogram and super-imposed standardised normal curve of regression's standardised residuals exhibited perfect normal distribution.

The Slope 'B' coefficients of gestational age, hospital stay, parity and Haemoglobin in logistic regression model to estimate low weight babies at birth of weight <2000gm were statistically significant. The age of mothers did not show any significant effect on delivery of low weight babies

The early neonatal mortality was as high as 71.3 per cent (RR=237.7) in birth weight group <1000gms and then, decreased consistently with weight at birth to 0.3 per cent in birth weight group 3000-3500 gms, thereafter it again increased with weight at birth; making a reverse 'J' type curve. The males had significantly higher P<0.001 early neonatal mortality 1.8 per cent as compared to females 1.4 per cent (RR=1.29).

The model had the sensitivity 91.6 per cent and specificity 56.5 per cent classifying correctly 88.5 per cent low birth weight babies with weight <2000gms at cut off probability 0.15.

Hosmer and Lemeshow statistics showed that the model had a very good fit. The ROC curve and its coordinates have also been given to estimate the sensitivity and specificity at different cut off points to estimate the low weight at birth <2000 gms, so that model can be used efficiently by the health care providers.

Age specific early neonatal mortality was highest 5.31/1000 (RR=6.4) in babies available at the beginning of the 1st day and 3.22/1000 (RR=3.9) in babies available at the beginning of the 2nd day. The early neonatal mortality decreased consistently till the 8th day in hospital and thereafter, it increased (as the babies of better health were discharged early).

Wilcox (1983) has confirmed that the perinatal mortality was closely related to weight at birth. Results established that the distribution of weight at birth is essentially Guassian, with additional births at lower ends, that divides the distribution in two components; i) a predominant distribution (Guassian) and ii) a residual distribution. Findings show that predominant distribution is largely of term births, while the residual distribution is composed almost entirely of pre-term births. Further, it is observed that the male babies are at a higher risk of dying during the perinatal period than female babies, despite the fact that the prevalence of low birth weight is higher in male babies than in female babies.

The differences in birth weight by the day of discharge were statistically significant but absolute differences cannot be said of any clinical importance. However, SD of the weight at birth of newborn babies on first and second days were the highest, indicating that newborn babies who left the hospital on the first and the second day had very low or very high birth weight. This has been confirmed by the fact that babies with weight at birth <2000gms were the highest when they were discharged on the first or on the second day from the hospital P<0.001 (due to higher mortality in early days of life).

The 71.6 per cent of the total variation of four variables viz. age, weight at birth, parity and maternal age were explained by the two principal components. The 1st Principal component is formed by gestational age (r=0.857) and baby weight at birth (r=0.855). This principal component is subject to monitoring and can be improved by better antenatal care. The 2nd principal component is formed by parity (r=0.831) and maternal age (r=0.830), and cannot be changed during a given pregnancy.

The Logistic regression model to estimate early neonatal mortality using age at death, sex and weight at birth revealed that the OR of mortality was as high as 982.5 in newborn babies born with weight at birth <1000gms and decreased consistently to 1.4 born with weight at birth 2500-3000gms and again increased to 2.5 in weight group ≥3500gms with respect to the mortality in babies born with weight at birth 3000-3500gms. The OR of mortality in male newborn babies was 1.7 times as compared to in females.

The model identified 98.4 per cent of the newborn babies' survival and mortality correctly with sensitivity 60.9 per cent and specificity 99.0 per cent at 0.15 cut of point. The ROC curve for early neonatal mortality of Logistic regression model along with its co-ordinates have been provided, so that the model can be used to estimate early neonatal mortality at different cut of points.

The Cox regression model of early neonatal mortality affected by groups of weight at birth as compared to weight group 3000-3500gms and in sex-male of the newborn has been given. The Relative Risk (RR) of early neonatal mortality in the newborn babies of weight at birth <1000gms was 327.8 as compared in the babies of weight at birth 3000-3500gms, and then, RR decreased consistently till the weight at birth reached 3500gms, thereafter, mortality increased, making a classical reverse 'J' type curve. The early neonatal mortality in male newborn is found to be 1.4 times that in female newborn.

The Cox Regression model reveals that the early neonatal mortality was highest in the 1st day of life and thereafter, it decreased consistently.

The analysis of variance reveals a linear relationship between birth weight and all maternal variables. Results also indicate significant deviation from linearity. These findings of linearity and deviation from linearity are contradictory, but statistically speaking this can happen because of large sample size.

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Table 1
Birth weight by age of mother

Age in Years	N (%)	<2000 (%)	RR	Mean	SD
<20	1016 (3.6)	104 (10.2)	1.19	2494	463
20-29	24566 (87.8)	2116 (8.6)	1.00	2574	469
30-39	2339 (8.4)	229 (9.8)	1.14	2588	512
40-	58 (0.2)	8 (13.8)	1.60	2529	448
Total	27979 (100.0)	2457 (8.8)	-	2572	473
	$\chi 2$;(DF=3)=8.34; P=0.039			F(3,27975)=10.3; P=0.001	

Table 2
Birth weight by parity

Parity	N (%)	<2000gm (%)	RR	Mean	SD
0	16128 (57.6)	1493 (9.3)	1.24	2540	464
1	9218 (32.9)	692 (7.5)	1.00	2624	471
2	2112 (7.5)	203 (9.6)	1.28	2600	501
3	400 (1.4)	55 (13.8)	1.84	2528	547
4-	121 (0.4)	14 (11.6)	1.55	2531	519
Total	27979 (100.0)	2457 (8.8)	-	2572	473
	χ2;(DF=4)=38.6; P=0.000			F(4,27974)=50.2; P=0.000	

Table 3a
Birth weight by the level of Haemoglobin

Hb	N (%)	<2000gm (%)	RR	Mean	S D
<7.0	1819 (6.5)	204 (11.2)	1.37	2528	486
7.0-8.9	3472 (12.4)	382 (11.0)	1.37	2518	489
9.0-10.9	19884 (71.1)	1640 (8.2)	1.00	2582	466
11-	2804 (10.0)	231 (8.2)	1	2594	482
Total	27979 (100.0)	2457 (8.8)	-	2572	473
	χ2;(DF=3)=42.9; P=0.000			F(3,27975)=25.3; P=0.000	

Table 3b
Results of analysis of variance between birth weight and haemoglobin level

Source of Variation		SS	DF	F	Sig.
Between	Combined	16.9	3	25.3	0
	Linearity	12.9	1	58	0
	Deviation from linearity	4	2	9.0	.000
Within Groups		6230.7	27975	Eta^2=0.003	
Total		6247.6	27978	R^2=0.002	

Table 4a
Birth weight by period of gestation

Period of gestation (months)	N (%)	<2000gms (%)	RR	Mean	S D
28-29	154 (0.6)	134 (87.0)	36.25	1387	553
30-31	226 (0.8)	180 (79.6)	33.17	1585	546
32-33	491 (1.8)	358 (72.9)	30.38	1718	508
34-35	1149 (4.1)	447 (38.9)	16.21	2091	510
36-37	4203 (15.0)	531 (12.6)	5.25	2418	442
38-39	17739 (63.4)	711 (4.0)	1.67	2650	404
40-	4017 (14.4)	96 (2.4)	1	2732	395
Total	27979 (100.0)	2457 (8.8)	-	2572	473
	$\chi 2$=7203;DF=3; P=0.000			F(6,27972)=1309.9; P=0.000	

Table 4b
Analysis of variance between birth weight and period of gestation

Source of Variation		SS	DF	F	Sig.
Between	Combined	1370.4	6	1309.9	0
	Linearity	1263.8	1	7248.3	0
	Deviation from linearity	106.6	5	122.3	0
Within Groups		4877.2	27972	Eta^2=0.219	
Total		6247.6	27978	R^2=0.202	

Table 5
Newborn babies with low birth weight

Days at Discharge	Total	Weight at Birth in gm.			
		<2000 gms (%)	RR	Mean	S D
1	41 (0.1)	6 (14.6)	3.11	2532	558
2	135 (0.5)	19 (14.1)	3	2504	569
3	1543 (5.5)	84 (5.4)	1.15	2599	434
4	2261 (8.1)	107 (4.7)	1	2599	422
5	2638 (9.4)	124 (4.7)	1	2595	424
6	2893 (10.3)	170 (5.9)	1.26	2588	429
7	18468 (66.0)	1947 (10.5)	2.23	2561	493
Total	27979 (100.0)	2457 (8.8)	-	2572	473
		χ2=231.0 DF=6 P=0.000		F=5.992 DF=6,27972 P=0.000	

Table 6
Rotated principal Component matrix (Varimax)

Extraction	Component (Variance explained=71.6)		Score Coefficient	
	Component 1 (36.8)	Component 2 (34.8)	1	2
GEST (0.74)	0.857		0.586	-0.069
BW (0.74)	0.855		0.582	0.062
Parity (0.69)		0.831	-0.009	0.595
Age (0.69)		0.83	0.002	0.594

Table 7
Regression model for birth weight

R^2=0.212; P=0.000

Model	B	SE	β	Sig.	95% CI of B	
Constant	1.141	0.025	-	.000	1.092	1.189
Gestation	0.228	0.003	0.443	.000	0.223	0.234
Hb	0.022	0.004	0.031	0	0.015	0.029
Age Groups	0.022	0.007	0.016	.003	0.007	0.036
Parity	0.050	0.004	0.078	.000	0.043	0.057
Hospital stay	-0.003	0	-0.045	0	-0.003	-0.002

Table 8
Logistic regression model to estimate low birth weight

Variables	B	S.E.	Sig.	OR	95% C.I. for OR	
Gestation wrt 40+; P=0.000						
28-29	5.666	.264	.000	288.9	172.3	484.5
30-31	5.016	.196	.000	150.8	102.6	221.7
32-33	4.631	.146	.000	102.6	77.0	136.6
34-35	3.196	.121	.000	24.4	19.3	31
36-37	1.747	.114	.000	5.7	4.6	7.2
38-39	.517	.111	.000	1. 7	1.4	2.1
Hospital Stay wrt 4-5 days; P=0.000						
1	.812	.581	.162	2. 3	0.7	7
2	1.052	.321	.001	2.9	1.5	5.4
3	0.037	.150	.807	1.0	0.8	1.4
6	.244	.116	.035	1.3	1.0	1.6
7+	.667	.081	.000	1.9	1.7	2.3
Age wrt 20-29 years; P=0.824						
<20	.058	.126	.648	1.1	0.8	1.4
30-39	.053	.089	.549	1.1	0.9	1.3
40+	.286	.463	.538	1.3	0.5	3.3
Parity wrt 4+; P=0.000						
0	.191	.347	.581	1.2	0.6	2.4
1	-.163	.348	.640	0.9	0.4	1.7
2	-.075	.355	.833	0.9	0.5	1.9
3	.111	.389	.776	1.1	0.5	2.4
Haemoglobin wrt 11+;P=.002						
<7	.341	.118	.004	1.4	1.1	1.8
7-9	.236	.103	.022	1.3	1.0	1.5
9-11	.058	.085	.492	1.1	0.9	1.3
Constant	-4.363	0.377	.000	0.01		

Sensitivity=91.6; Specificity=56.5; Correctly Classified=88.5;
Cut of Point=0.15
Hosmer and Lemeshow Test; $\chi 2=5.2$; DF=7; P=0.641

Table 9
Sex, birth weight and early neonatal mortality

a) Sex χ^2=8.0, DF=1	Died (%)	RR	Total (%)
Total	568 (1.6)	-	35151 (100.0)
Male	331 (1.8)	1.29	18417 (100.0)
Female	237 (1.4)	1.00	16734 (100.0)
b) Prognosis by birth weight χ^2=6058.6, DF=6			
<1000	77 (71.3)	237.7	108 (100.0)
1000-	171 (24.8)	82.7	689 (100.0)
1500-	131 (5.4)	18.0	2439 (100.0)
2000-	97 (1.0)	3.3	9509 (100.0)
2500-	69 (0.4)	1.3	15552 (100.0)
3000-	19(0.3)	1.0	6076 (100.0)
3500-	6 (0.7)	2.3	819 (100.0)
c) Age specific early neonatal mortality/1000 babies available in the beginning of the day			
			Actual
1	187(5.31)	6.40	35192
2	112(3.22)	3.88	34815
3	70(2.05)	2.47	34164
4	44(1.40)	1.69	31491
5	33(1.17)	1.41	28221
6	23(0.98)	1.18	23490
7	18(0.94)	1.13	19197
8	13(0.83)	1.00	15579
9	11(1.02)	1.23	10747
10	12(1.68)	2.02	7122
11+	47(9.89)*	11.92	4752

*It is assumed that all babies those were available at the beginning of the 11th day were discharged after 11 day for the computation of mortality at 11th day, when it was not so.

Table 10a
Logistic regression model to estimate mortality using age at death, sex and weight at birth (R^2=0.514)

Variables	B	S.E.	Sig.	OR	95.0% C.I.	
Age at Death (in days) wrt 7+ days						
1	5.491	0.191	.000	242.4	166.6	352.8
2	4.170	0.182	.000	64.7	45.3	92.5
3	2.367	0.182	.000	10.7	7.5	15.2
4	1.716	0.202	.000	5.6	3.7	8.3
5	1.075	0.218	.000	2.9	1.9	4.5
6	0.742	0.245	.003	2.1	1.3	3.4
SEX (Male)	0.527	0.112	.000	1.7	1.4	2.1
Weight at Birth wrt 3000-3500						
<1000	6.890	0.369	.000	982.6	476.5	2026.4
1000-	5.024	0.273	.000	152.1	89	259.8
1500-	3.189	0.262	.000	24.3	14.5	40.6
2000-	1.307	0.259	.000	3.7	2.2	6.1
2500-	.370	0.266	.164	1.4	0.9	2.4
3500-	0.931	0.489	0.057	2.5	1	6.6
Constant	-7.706	0.277	0	Correctly identified=98.4		

Sensitivity=60.9; Specificity=99.0); Cut of point P=0.15
Hosmer and Lemeshow Test; $\chi 2$=18.4; DF=7; P=0.010

Table 10b
Coordinates of the ROC curve of logistic model
with birth weight, age at death and sex as predictors
Area= 0.941; SE=0.006; 95%CI=0.929-0.953

Positive if	Sensitivity	1 - Specificity
0.009	0.903	0.168
0.021	0.842	0.063
0.034	0.815	0.046
0.039	0.808	0.042
0.054	0.778	0.035
0.065	0.748	0.026
0.081	0.731	0.022
0.101	0.695	0.019
0.118	0.632	0.012
0.145	0.609	0.010

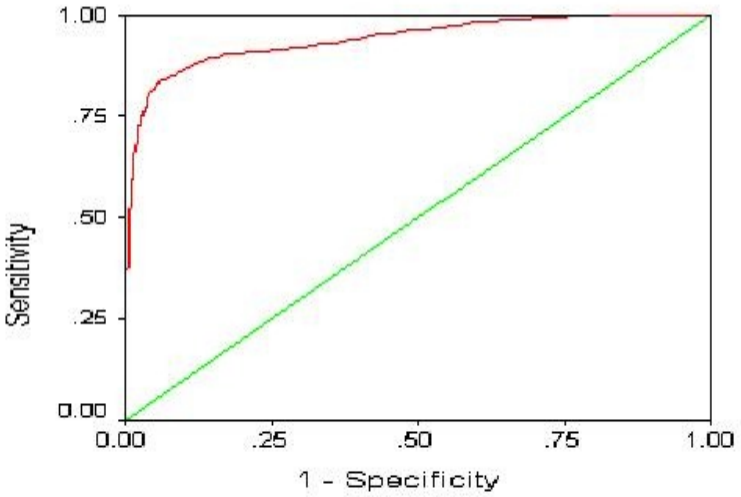
Table 11a
Variables in Cox regression

Variables	B	SE	Sig.	Exp(B)	95.0% CI for Exp(B)	
$\chi 2$=5750						
DF=7					Lower	Upper
BW wrt 3000-3500						
<1000	5.792	0.257	.000	327.8	198.2	542.0
1000-	4.411	0.242	.000	82.4	51.2	132.4
1500-	2.853	0.246	.000	17.3	10.7	28.1
2000-	1.235	0.251	.000	3.4	2.1	5.6
2500-	0.398	0.259	.125	1.5	0.9	2.5
3500-	0.817	0.468	.081	2.3	0.9	5.7
Sex (Male)	0.352	0.085	.000	1.4	1.2	1.7

Table 11b
Cox regression survival table

Days	Baseline Cumulative Hazard	At mean of covariates		
		Survival	SE	Cumulative Hazard
1	0.001	0.998	0	.002
2	.001	.996	0	0.004
3	.002	.995	.000	0.005
4	.002	.995	.000	0.005
5	.002	.994	.000	0.006
6	.002	.994	.000	0.006
7	.003	.992	.001	0.008

Figure 1
ROC curve for logistic regression model
using birth weight, sex and age at death



Correlates of Nutritional Status of Children in Madhya Pradesh

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Introduction

In the developing countries, children are vulnerable to under nutrition because of low dietary intake, prevalence of infectious diseases, lack of appropriate care and inequitable distribution of food within the household. Adequate nutrition is critical to child development. The period from birth to two years of age is important for optimal growth, health and development of the child. At this age, children are particularly vulnerable to growth retardation, micro-nutrient deficiencies and common childhood illnesses such as diarrhoea, anaemia and acute respiratory infection. According to Winikoff (2000), diarrhoea is a serious disease in developing countries, are known to be the immediate precipitant of such nutritional disorders as Marasmius, Kwashiorkor and xerophthalmia. It is also well known that poor nutritional status plays a major role in increasing both the susceptibility to and the severity of infection.

The nutritional status of the child is strongly related to the nutritional status of the mother. Under nutrition in children is more prevalent in children whose mother's body mass index is below 18.5 as compared to children whose mother's body mass index is above 18.5. The nutritional status of children is also directly related to the standard of living index. Children from households with low standard of living index are twice as likely to be under nourished as children from households with a high standard of living index.

Inadequate nutrition is a problem throughout India but in Madhya Pradesh under nutrition is more pronounced. According to the National

Family Health Survey 2005-06, about 58 per cent of children below five years of age in Madhya Pradesh were found to be low weight for age while about 40 per cent were low weight for height while about 47 per cent were small height for age. This means that both chronic and short duration under nutrition is quite substantial in the state (IIPS 2007).

In this paper, we attempt to give a brief outline of the under nutrition in children below five years of age in Madhya Pradesh as well as the risk of diarrhoea and acute respiratory infections.

Data and Methodology

The analysis is based on the information available through the National Family Health Survey 2005-06. In Madhya Pradesh, the survey covered 2730 children below five years of age. The survey collected information related to the anthropometric measurement of all children below five years of age included in the sample along with information related to a range of social, economic and demographic variables including age, sex, birth order, residence, mother's education, religion, caste and standard of living. The survey also collected information about the prevalence of diarrhoea and acute respiratory infections in children. The anthropometric data available through the survey was used to assess the nutritional status of the child. Actual calculations were based on the application of the ANTHRO software developed by the World Health Organisation which is based on the new global standard (WHO). Using this software, three indices commonly used for measuring the nutritional status - weight-for-age, height-for-age and weight-for-height - were calculated for each child included in the sample. The three indices reflect the three dimensions of nutritional status in children. The low height-for-age, for example reflects the chronic, long term under nutrition and is generally termed as stunting. On the other hand, low weight-for-height reflects the short duration under nutrition of immediate context and is generally termed as wasting. Finally, the low weight-for-age reflects the combined effect of height-for-age and weight-for-height and is the most widely used indicator of the nutritional status of the child.

Actual assessment of the nutritional status of the child is done by converting the observed values of age, weight and height of the child into standard normal variate (Z) by comparing them with the mean and standard deviation of the standard population. The nutritional status of the child was classified as normal if the Z-score ranged between 0.00

and -2, moderately under nourished if the Z-score ranged between =2 and -3, and severely under nourished if the Z-score was mor than -3.00.

The National Family Health Survey also provides information about the prevalence of diarrhoea and acute respiratory infections in children. The prevalence rate is estimated on the basis of the information provided by the parents or other elder members of the child. Details about the methodology for identifying cases of diarrhoea and acute respiratory infections applied during the National Family Health Survey is available elsewhere and not repeated here (IIPS 2007).

Results and Discussion

Nutritional Status of Children. The level of under nutrition in children below five years in the state is reflected in table 1. Among the 2730 children below five years of age covered during the National Family Health Survey 2005-06, about 52 per cent were stunted, more than 38 per cent were wasted while more than 58 per cent were low weight for age according to the standards laid down by the World Health Organisation. It is also clear from the table that most of the under nutrition in children below five years of age in the state was mild, a small proportion was moderate and an almost negligible proportion having severe under nutrition which requires hospitalisation.

Table 1 also presents prevalence of stunting, wasting and under weight by basic characteristics of children and their families. The prevalence of stunting and under weight has been found to be the highest in the age group 24-35 months whereas the prevalence of wasting has been found to be the highest in the age group 6-11 months. It is clear from table 1 that the age pattern of stunting and under weight follows a reverse U shape curve whereas the prevalence of wasting decreases monotonically after 6-11 months of age. The table also suggests that even during the first six months of life, when most babies are breastfed, the prevalence of under nutrition is quite high. It is also interesting to observe from the table that the prevalence of severe under nutrition is the highest in children less than 6 months of age. This suggests that the growth of the child has not been normal during pregnancy which may be due to the poor nutritional status of the mother.

As regards sex differentials in the prevalence of under nutrition, there appears very little difference in the prevalence of stunting, wasting and under weight between boys and girls. On the other hand, there is a clear indication that prevalence of under nutrition as defined

in terms of the three indices increases with the increase in birth order; the prevalence has been found to be the highest in children with birth order 6.

Overall, prevalence of under nutrition has been found to be high in girls than in boys. Under nutrition is generally lower for first births than for subsequent births and consistently increases with the increase in the birth order for all measures of nutritional status. Short birth intervals are associated with higher levels of under nutrition, except in the case of wasting. Children who are judged by their mother to have been small or very small at the time of birth are more likely to be under nourished.

Under nutrition has been found to be substantially higher in rural areas than in urban areas of the state. Even in the urban areas, 56 per cent of children have been found to be stunted, 69 per cent wasted, and 52 per cent underweight. As compared to urban children, rural children are more under nourished due to the economic and social backwardness. Under nutrition has a strong positive relationship with the education of the mother. The proportion of children who have been found to be severely stunted is almost one to two times as high for children whose mother has no education as compared to children whose mother has 12 or more years of education. Hindu and Muslim children are about equally likely to be under nourished, but children from other communities (Christian, Sikh, and Jain) are considerably better nourished. Children belonging to Scheduled Castes, Scheduled Tribes, and other backward classes have relatively high levels of under-nutrition in terms of all the three measures of nutritional status. Children belonging to Scheduled Tribes have the poorest nutritional status. The prevalence of all of the three measures of nutritional status decrease steadily with an increase in the living standard of the family living. Children from households with a low standard of living are twice as likely to be under nourished as children from households with a high standard of living.

Prevalence of Diarrhea and Acute Respiratory Infection. Diarrhoea is the single most common cause of death among children below five years of age. The prevalence of diarrhoea is estimated to be around 13 per cent while that of acute respiratory infections (ARI) is estimated to be 6 per cent in Madhya Pradesh. Deaths from acute diarrhoea are usually caused by dehydration due to loss of water and electrolytes. Early diagnosis and treatment with antibiotics can prevent a large proportion of deaths caused by ARI. In National Family Health Survey, the prevalence of ARI was estimated by asking mothers whether their

children below five years of age had cough accompanied chest related short, rapid breathing in the two weeks preceding the survey.

Results of the multinomial regression analysis are given in tables 2 through 4 with the dependent variable being stunting, wasting and underweight respectively. The regression coefficients are in expected direction. For example, the odds of a child being stunted are the highest in children aged 12-35 months and lowest in children aged 0-11 months. Male children have relatively lower odds of being stunted compared to female children although the difference is not statistically significant. However, in case of wasting, the sex difference is found to be statistically significant. In case of underweight, odds of being severely underweight is statistically significantly higher in males as compared to females. The probability of a child getting stunted increases with the birth order, whereas Scheduled Castes/Tribes children are more likely to be stunted than the upper castes children. Similarly, mother's education has a strong impact on the nutritional status of children.

In case of wasting and underweight also, a similar situation appears to prevail in the state. The results of the regression analysis confirm that the nutritional status of the child is strongly influenced by the social, economic and demographic characteristics of the child and the mother. This means that reduction in the prevalence of under nutrition requires a multi-dimensional, development oriented approach.

Conclusions

The analysis presented here highlights the complexities involved in tackling the problem of under nutrition in children which is so pervasive in the state. Given the very strong social, economic and cultural dimensions of under nutrition in children, the techno-clinical approach of reducing under nutrition may not be a viable preposition. Nutritional status of the child is a reflection of the broad social and cultural milieu of the society which is conditioned by the economic status of households. As such, more pragmatic and culturally acceptable approaches are needed to tackle the problem of under nutrition in children.

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Table 1
Nutritional status of children in Madhya Pradesh, 2005-06

	Stunting			Wasting			Underweight		
	Moderate	Severe	N	Moderate	Severe	N	Moderate	Severe	N
Age (in months)									
<6	15.0	16.2	234	20.0	29.5	220	23.9	23.9	234
6-11	15.8	9.6	311	23.8	21.5	311	27.3	20.9	311
12-23	26.3	29.6	520	20.4	17.0	519	30	29	520
24-35	24.7	35.3	515	19.7	13.6	513	30.3	30.9	515
36-47	23.1	27.8	589	19.2	12.6	588	33.4	27.3	589
48-59	22.8	23.5	553	18.5	13.2	552	32.4	25.9	553
Sex of child									
Male	21.5	26.1	1424	21.0	17.6	1417	29.6	28.1	1424
Female	23.4	25.2	1298	18.9	14.5	1286	31.4	25.8	1298
Birth order									
1	20.8	19.2	787	17.6	17.0	784	27.8	22.5	787
2-3	22.9	23.3	1190	21.6	15.6	1178	31	24.9	1190
4+	23.2	36.2	745	20.0	16.2	741	32.3	35.2	745
Residence									
Urban	21.1	19.6	1169	18.4	16.0	1160	28.7	21	1169
Rural	23.4	30.2	1553	21.1	16.3	1543	31.7	31.6	1553
Mothers education									
Nill	23.4	32.9	1278	20.6	17.1	1269	31.1	34.8	1278
Primary	22.4	23.3	460	23.8	13.8	458	35.2	23.5	460
Primary+	21.1	17.3	984	17.4	16.1	976	27.3	18.5	984
Religion									
Hindu	22.6	26.0	2415	19.9	16.2	2398	30	27.7	2415
Muslim	21.6	23.9	259	21.0	16.7	257	33.6	23.6	259
Others	16.7	14.6	48	18.8	12.5	48	35.4	8.3	48
Caste									
SC/ST	24.6	31.0	1032	20.6	18.2	1028	30.8	35.6	1032
OBC	21.4	26.3	1098	20.0	13.4	1089	32.5	23	1098
Others	20.4	15.0	592	18.8	17.7	586	26	19.6	592
Family living standard									
Low	21.7	32.0	998	20.7	19.3	993	30.6	34.7	998
Medium	25.6	28.6	761	21.5	15.0	755	31.5	30.1	761
High	20.6	16.7	963	18.0	13.8	955	29.5	16.6	963
Total	22.4	25.6	2722	20.0	16.2	2703	30.5	27	2722

Source: Computed from NFHS 2005-06 data.

Table 2
Multinomial logistic regression parameter estimates for stunting

Background Characteristics	Stunting	
	B (Exp β) Moderate [a]	B (Exp β) Severe [a]
Age of child (months)		
36-59 (Ref)		
12-35	0.362(1.436)*	0.534(1.705) *
0-11	-0.752(0.472)*	-1.099(0.333)*
Sex of child		
Female(Ref)		
Male	-0.059(0.943)	0.097(1.102)
Birth order		
4+(Ref)		
2-3	-0.195(0.823)	-0.506(0.603) *
1	-0.329(0.720)**	-0.669(0.512) *
Residence		
Rural(Ref)		
Urban	-0.169(0.845)	-0.239(0.787) **
Mothers education		
Above primary (Ref)		
Primary	-0.055(0.947)	-0.001(0.999)
No education	0.096(1.101)	0.331(1.393) **
Religion		
Others(Ref)		
Muslim	0.377(1.458)	0.317(1.373)
Hindu	0.285(1.330)	0.065(1.067)
Caste		
Others(Ref)		
OBC	0.125(1.133)	0.512(1.669) *
SC/ST	0.387(1.473) **	0.693(2.000) *
Family living standard		
High(Ref)		
Medium	0.322(1.379) **	0.415(1.514) *
Low	0.089(1.093)	0.409(1.505)**
-2 Log likelihood	2707.114	
Mc Fadden R square	0.060	
Total number of cases	2722	

#- Significant at $\alpha = 0.05$ ** and $\alpha = 0.01$*.

a. The reference category is: Normal.

Table 3
Multinomial logistic regression parameter estimates for wasting

Background Characteristics	Wasting	
	B (Exp β) Moderate [a]	B (Exp β) Severe [a]
Age of child (months)		
36-59 (Ref)		
12-35	0.128(1.136)*	0.221(1.248)**
0-11	0.435(1.545)	0.901(2.462)*
Sex of child		
Female(Ref)		
Male	0.201(1.222) **	0.275(1.316) **
Birth order		
4+(Ref)		
2-3	0.160(1.174)	0.058(1.059)
1	-0.060(0.941)	0.073(1.076)
Residence		
Rural(Ref)		
Urban	-0.093(0.911)	0.098(1.103)
Mothers education		
Above primary (Ref)		
Primary	0.308(1.361) **	-0.126(0.882)
No education	0.130(1.139)	0.008(1.008)
Religion		
Others(Ref)		
Muslim	0.138(1.149)	0.406(1.501)
Hindu	-0.021(0.979)	0.324(1.383)
Caste		
Others(Ref)		
OBC	-0.081(0.922)	-0.412(0.662) **
SC/ST	0.006(1.006)	-0.087(0.917)
Family living standard		
High(Ref)		
Medium	0.150(1.162)	0.249(1.282)
Low	0.161(1.175)	0.541(1.717) *
-2 Log likelihood	2511.328	
Mc Fadden R square	0.020	
Total number of cases	2703	

Table 4
Multinomial logistic regression parameter estimates for underweight

Background Characteristics	Underweight	
	B (Exp β) Moderate [a]	B (Exp β) Severe [a]
Age of child (months)		
36-59 (Ref)		
12-35	-0.028(0.972)	0.205(1.228) **
0-11	-0.482(0.617) *	-0.442(0.643) *
Sex of child		
Female(Ref)		
Male	0.019(1.019)	0.191(1.211) **
Birth order		
4+(Ref)		
2-3	-0.177(0.838)	-0.336((0.714) **
1	0.308(0.735) **	-0.395(0.674) **
Residence		
Rural(Ref)		
Urban	-0.217(0.805) **	-0.202(0.817)
Mothers education		
Above primary (Ref)		
Primary	0.296(1.344) **	0.124(1.132)
No education	0.244(1.277) **	0.443(1.557) *
Religion		
Others(Ref)		
Muslim	-0.029(0.971)	0.973(2.646)
Hindu	-0.401(0.670) **	0.763(2.145)
Caste		
Others(Ref)		
OBC	0.309(1.362) **	-0.009(0.991)
SC/ST	0.489(1.631) *	0.530(1.699)*
Family living standard		
High(Ref)		
Medium	0.070(1.072)	0.448(1.630) *
Low	0.087(1.091)	0.595(1.813) *
-2 Log likelihood	2879.408	
Mc Fadden R square	0.042	
Total number of cases	2722	

Prevailing Breast Feeding Practices and Impact of Educational Intervention on Benefits of Exclusive Breast Feeding

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Introduction

The importance of breast milk for infants is unparallel. It is the most effective and complete source of nutrition for the new born. Nutritional elements present in human milk not only provide optimal nutrition and prevent diarrhoeal and respiratory tract infections in infants but also favour an optimal psycho-social development. They also play an important role during the adult life by preventing obesity, diabetes, arterial hypertension and atherosclerosis. Exclusive breast feeding during the first six months of life has been recommended by health agencies the world over. It has been estimated that improved breast-feeding practices can save up to 1.5 million lives every year. Unfortunately, the goal of universal exclusive breast feeding in India still remains elusive in spite of various programmes and policies adopted by the Government of India. According to the National Family Health Survey 2005-06, only about 24.5 per cent of mothers in India initiate breastfeeding within one hour after birth, about 46 per cent breastfeed exclusively for the first six months and about 57 per cent nurse the baby beyond six months with the introduction of complementary food (IIPS 2007). Early cessation of breastfeeding, needless supplementation and poorly timed complementary feeding practices are the major stumbling blocks in the normal growth and development of the child. The present study has been carried out to analyse patterns of infant feeding practices adopted by mothers attending an immunisation clinic in Madhya Pradesh and to determine

the beneficial effects of breast milk on infants. Specific objectives of the study are as under:

- To assess the knowledge, attitude and practice regarding breast feeding.
- To compare the frequency of diarrhoeal and respiratory tract infections between breast fed and top fed infants.
- To compare the length and weight of breast fed and top fed infants.

Methodology

The study was undertaken at Chacha Nehru Bal Chikitsalya, Indore over a period of three months during October through December 2007. A total of 75 randomly selected male infants aged 6 weeks attending the immunisation clinic of the hospital were recruited for the study. The infants selected for the study were divided into two groups - infants exclusively breast fed (EBF group) and infants who had received top feeding. There were 25 infants in the first group and the remaining 50 infants were in the second group. The top feed group was randomly divided into two groups of 25 infants each. Educational intervention regarding the benefits of breast feeding was provided to one group (intervention group) while no intervention was made in the other group which served as the control group. Infants in experimental groups were followed at 10 weeks and 14 weeks of age. The incidence of diarrhoea and respiratory tract infections were noted in the three groups at the end of the intervention period and weight and length of the infants was also recorded on the basis of a pre-designed and pre-tested information schedule. The data collected during the study were analysed using SPSS version 11.

Results

Knowledge, Attitude and Practice Regarding Breast Feeding. It was observed that 17 (68 per cent) of mothers in the EBF group were aware regarding the initiation of breast-feeding within one hour of birth as compared to 26 (52 per cent) in the top fed group. The difference, however, was not found to be statistically significant. Moreover, 56 (74.7 per cent) mothers recognised the importance of colostrum feed and fed the infants with colostrum. Knowledge regarding colostrum was significantly higher in the EBF group (96 per cent) as compared to the top fed group (66 per cent) and the difference was statistically significant ($\chi 2 = 4.66$, $p=0.03$). None of the mothers in the EBF group had practised pre-lacteal feeding whereas 24 (48 per cent) mothers in the top fed group had done so ($\chi 2 =$

15.51, p <0.001). Generally, breast feeding was on demand as 49 (65.3 per cent) mothers practised on demand feeding. Knowledge about correct positioning of the child during breastfeeding was higher (72 per cent) in the EBF group as compared to in the top fed group (62 per cent). The median period of breast feeding was 10-15 minutes. Just 4 (5.3 per cent) respondents informed that they breast fed the infant for more than 15 minutes in one sitting. On the other hand, 45 (60 per cent) mothers informed that they used to breast feed the infant 8-10 times during the day and this proportion was higher (76 per cent) in EBF group as compared to the top fed group(52 per cent). About one third of the respondents reported that they breastfed the child for more than 10 times per day.

Mothers covered in the study were also inquired about the method they adopted for top feeding. Majority of the women (64 per cent) informed that they used bottle/tumbler for feeding purposes whereas 18 (36 per cent) reported that they used spoon and bowl.

Morbidity due to Diarrhoea and Respiratory Tract Infections in Infants. The infants in the three groups were followed up for a period of eight weeks for episodes of diarrhoea and respiratory tracts infections. During this period, number of infectious spells were recorded. Maximum number of episodes of diarrhoea (14) were reported in the control group: 6 between 6-10 weeks and 8 between 10-14 weeks. The number of episodes of diarrhoea in the intervention group were 4; 1 between 6-10 weeks and 3 between 10-14 weeks while only one episode was reported between 6-10 weeks in the EBF group and none in the succeeding month. In all 14 infants were reported to have suffered from diarrhoea. Out of these, 10 were from the control group, 3 were from the intervention group one was from the EBF group. The difference in the intervention and control group was statistically significant ($\chi 2 = 5.09$, $p < 0.05$).

On the other hand, a total of 13 episodes of respiratory tract infections were reported in the infants included in the study during the study period out of which 10 were in the control group, 3 were in the intervention group and one in the exclusive breast feeding group. A total of 11 infants suffered from respiratory tract infections during the study period. Out of these 8 were in the control group, 2 were in the intervention group and 1 in the EBF group. The difference in the proportion of children suffered from reproductive tract infections between the intervention and control group was statistically significant ($\chi 2 = 4.50$, $p < 0.05$).

Weight and Length of Infants. The mean weight of infants covered in the study was 4.5 kg, 4.2 kg and 4.0 kg at 6 weeks of age in the EBF, intervention and control groups respectively. At the end of the intervention period, the mean weight in the three groups was 6.4 kg, 5.8 kg and 5.0 kg respectively. The difference in the weights of the infants in the intervention and control groups was found to be statistically significant ($t=8.914$, $p<0.001$).

The mean length of infants in the three groups at the initiation of the study was 56.02 cm, 54.07 cm and 55.08 cm respectively and at the end of the study was 61.92 cm, 59.90 cm and 57.83 cm respectively. The difference in lengths between the intervention and control groups was statistically significant ($t=14.9$, $p<0.001$).

Discussion

The findings of the present study suggest that adequate knowledge regarding practices and benefits of breast feeding is still lacking among mothers. Overall 43 (57.3 per cent) mothers in the study had initiated breast feeding within one hour of birth and this proportion is higher than that reported in the National Family Health Survey 2005-06 as well as in other studies (Singh et al 1997, Banapurmath et al 19962, Chaturvedi et al 2007, Krishi Gram Vikas Kendra 2006). The difference might be attributed to the fact that the study was carried out in a tertiary health care set-up with majority of mothers coming from an urban setting. The suckling reflex is very strong in the first half hour of birth (Pandit 2000) and helps the release of hormone oxytocin resulting in uterine contraction that facilitates expulsion of placenta and reduces the risk of postpartum haemorrhage (IIPS 2000). Studies have also concluded that early breast feeding reduces the diarrhoeal episodes in the first six months of life (Clements et al 1999). Hospital staff and health care workers have to be vigilant and facilitate initiation of breast feeding within one hour of the birth. Dais should also be educated on this aspect to promote early feeding for home deliveries.

Colostrum feeding remains inconsistent in our society. A study by Srivastava et al on 1000 women reported that more than 82 per cent of mothers discarded colostrum (9). Studies in other parts of the country have also reported poor colostrum feeding (Singh et al 1997, Krishi Gram Vikas Kendra 2006). Pre-lacteal feeding is also widely prevalent (Singh et al 1997, Banapurmath et al 19962, Chaturvedi et al 2007, Srivastava et al 1994). A study in 28,630 households in Bihar revealed that half of the women had discarded colostrum on the advice of elders

(Yadav and Singh 2004). In this study an association has been observed between EBF and colostrum feeding. Colostrum is the welcome food for the newborn. It has a number of immunising properties. Efforts have to be made to universalize colostrum feeding. Faulty traditions and beliefs in the society have to be tackled to universalise colostrum feeding immediately after birth. Pre lacteal feeds not only increase the risk of infections but also decrease the duration of breast feeding which in turn suppresses milk production (Government of India 2006). Programmes should be devised to promote colostrum feeding and minimise pre-lacteal feeding.

The present study has revealed that only 49 per cent mothers practised demand feeding and just about 5 per cent breast feed the baby for more than 15 minutes in a single sitting. Proper period of breast feeding is important. Shorter period of breast feeding deprives the child of the hind milk which is a rich source of fat. Optimally, feeding should be continued from one breast until the child itself leaves the breast. In the top fed group, bottle feeding was being practised by 64 per cent of the respondents. Bottle feed is to be avoided as it not only makes the infant more prone to infections but also decreases the supply of the milk of the mother and the baby starts refusing the breast because of nipple confusion.

Several studies have reported that EBF tends to lower episodes of diarrhoea and reproductive tract infections in infants (Rama Ram et al 2000, Mihirshahi et al 2007, Mihirshahi et al 2008). The benefits of EBF are not limited to diarrhoea and respiratory tract infections alone. They also provide protection against diseases like atopic dermatitis, asthma (young children), obesity, type 1 and 2 diabetes and childhood leukemia. Relative better growth of infants in the EBF group is yet another benefit of exclusive breast feeding as observed by the findings of the present study. The average weight of infants in the intervention group has been found to be statistically significantly different from that in the control group ($t = 8.9$, $p<0.001$). Similarly, the average length of infants in the intervention group has been found to be statistically significantly different from that in the control group ($t = 14.9$, $p<0.001$).

Conclusions

A number of initiatives have been taken to universalise EBF, yet a lot is still desired. It is estimated that nearly 77 per cent (1.06 million) child deaths in the world attributable to sub-optimal breastfeeding are due to non-exclusive breastfeeding during 0-6 months of life (Krithika 2008).

The benefits of breast feeding are well established. The is a need to formulate innovative community based programmes and novel health promotion strategies to universalise breastfeeding for the benefit of infants and young children.

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Table 1
Knowledge about time of initiation of Breast Feeding

S.N.	Time of initiation	EBF group	Top fed group	Total
1	Within 1 hour of birth	17 (68.0)	26 (52.0)	43 (57.3)
2	After 1 hour of birth	08 (32.0)	24 (48.0)	32 (42.7)

$\chi^2 = 1.744$, p=0.187
Remarks: Figures in parentheses denote percentages.

Table 2
Knowledge about Colostrum feeding

S.N.	Colostrum feeding	EBF group	Top fed group	Total
1	Yes	23 (96.0)	33 (66.0)	56 (74.7)
2	No	02 (4.0)	17 (34.0)	32 (25.5)

$\chi^2 = 4.66$, p=0.03
Remarks: Figures in parentheses denote percentages.

Table 3
Feeding practice in the study groups

S.N.	Feeding practice	EBF group	Top fed group	Total
1	On demand	18	31	49
		(72.0)	(62.0)	(65.3)
2	Pre-decided time	7	19	26
		(28.0)	(38.0)	(34.7)

Table4
Prelacteal feeding in the study groups

S.N.	Colostrum feeding	EBF group	Top fed group	Total
1	Yes	0	24	24
		(0)	(48.0)	(32.0)
2	No	25	26	51
		(4.0)	(52.0)	(68.5)

Table 5
Knowledge about duration of Breast feeding

S.N.	Duration	EBF group	Top fed group	Total
1	< 10 minutes	04	21	25
		(16.0)	(42.0)	(33.3)
2	10 – 15 minutes	19	27	46
		(76.0)	(54.0)	(61.4)
3	>15 minutes	02	2	4
		(8.0)	(4.0)	(5.3)

Household Environment and Individual Risk Factors of Acute Respiratory Infections in Madhya Pradesh and West Bengal

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H. Lhungdim

Introduction

For the past couple of decades, environment has increasingly become an important area of concern as it impacts on the climate change and health status of the people. Both developed and developing countries are reeling under various environmental stress. Poverty entities as well as rapid urbanisation and the resulting pollution act as catalyst to environmental degradation and cause of several diseases. Pollution is the silent killer at the micro level but brings about destruction to the ecology at the macro level. Besides environmental factors, individual lifestyle factors such as tobacco smoking also aggravate health in the form of respiratory infections.

Respiratory infections are caused both by outdoor and indoor air pollution. The indoor air pollution can originate from both outdoor and indoor sources. Generally, outdoor pollutants get modified or diluted within the house by various physical and chemical processes. The household environment is also characterised by indoor pollutants generated through the type of fuel/fire used primarily for cooking and also for heating, source of lighting, ventilation, etc. It also gets polluted by human activities and lifestyle patterns such as tobacco smoking and tobacco chewing and crowding as indicated by number of persons sharing a room. Most importantly, when indoor sources or human activities emit pollutants at rates exceeding their removal rates by

ventilation or surface reactions, the indoor pollution level becomes more toxic than outdoor concentrations (Kumar 2001).

Acute Respiratory Infections afflict infants and children aged 1-4 years more than older children and adults. These infections are of two types - upper respiratory tract infection (AURI) and lower respiratory tract infection (ALRI). The former include common cold, pharyngitis and otitis media, while epiglottitis, laryngitis, laryngotracheitis, bronchitis and pneumonia constitute the latter. These infections which also include asthma, are global health concern, caused by genetic or environmental factors. Difficulty in breathing and coughing for long duration, shortness of breath and breathlessness are the common symptoms.

The air pollution is increasing day by day, intensifying the susceptibility of acute respiratory infections. In general, the association between exposure to environmental tobacco smoke (ETS) and the prevalence of acute respiratory infections is stronger in young children than in adults. Epidemiological studies have linked passive smoking in children to increased occurrence of lower respiratory tract infections during infancy and early childhood. Investigations throughout the world have demonstrated an increased risk of bronchitis and pneumonia during the first year of life in infants with smoking parents. Maternal (rather than paternal) smoking alone can increase the incidence of lower respiratory illness (Kumar et al 2001). According to the World Health Organisation (2004), worldwide, about 1.3 billion people were smokers and in India 29.4 per cent of adult men and 2.5 per cent of adult women were smoking. Although women smokers constitute a very small proportion of total smokers, yet, their smoking habit may cause life threatening respiratory infections to their children, especially those who are still nursing or more dependent on them.

Thick acrid smoke associated with fire inside the home is estimated to be accountable for around 1.6 million deaths per year in developing countries. This implies that one life is lost every 20 seconds to the killer kitchen. Nearly half of the households in the world continue to cook with solid fuels such as dung, wood, agricultural residues and coal (WHO/UNDP 2004). The figure is even higher for India, nearly 70 per cent (IIPS 2007). People in developing countries are regularly exposed to very high levels of pollution for 3–7 hours daily over many years. During winter and in cold and mountainous areas, exposure may occur over a substantial period daily. Because of their customary involvement in cooking, women are more exposed and vulnerable to smoke

generated infections than men. Young children are often carried on their mother's back while cooking is in progress and, therefore, spend many hours breathing smoke (WHO 2000).

Acute Respiratory Infections account for about 25 per cent of all deaths due to communicable diseases (HII 2004). About 4.1 million children in the world died due to these infections in 1998 and 40 per cent of them were from India, Bangladesh, Nepal and Indonesia (WHO 1999). In India, 13 per cent of all deaths in the hospitals are ascribed to acute respiratory infections. In absolute numbers, this amounts to around 987 thousand deaths in 1998 alone (WHO 2007). More recent data from the third round of the National Family Health Survey suggest that proportion of children having symptoms of acute respiratory infections is around 5.8 per cent (IIPS 2007).

Dense crowding in indoor sleeping quarters during cold and wet seasons has also been found to be one of the important factors responsible for the transmission of respiratory virus in children in a comparative study of village, peri-urban and crowded urban environments of West Bengal (Bang et al 1975). It is observed that with the rise in pollution level and population density, the situation may deteriorate. Home dampness was found to be significantly associated with symptoms of respiratory infections in primary school going children in rural Taiwan (Yang et al 1997b). Traditional houses with no windows have been found to be an environmental risk factor for under-five mortality in a case reference study in rural Ethiopia (Shaembo et al 1993).

In this paper, we attempt to analyse effects of household environment and individual life style patterns on the respiratory health of children aged 0-5 years, as indicated by the prevalence of acute respiratory infections (ARI) in two states of India - Madhya Pradesh (MP) and West Bengal (WB). More specifically, the paper attempts to associate the prevailing household environment and individual life style patterns with the prevalence of acute respiratory infections in children of the two states to elaborate how household environment and individual life style patterns impact upon the respiratory health of children.

Data and Methodology

The analysis presented in the following pages is based on the third round of the National Family Health Survey (NFHS-3) that was carried out during 2005-06. NFHS-3 covered 109,041 households, 124,385

women aged 15-49 years and 74,369 men aged 15-54 years throughout the country. The present analysis is restricted to two states of India - Madhya Pradesh and West Bengal. The prevalence of acute respiratory infections in Madhya Pradesh has been estimated to be quite low (3.7 per cent) as compared to West Bengal (13 per cent) despite the fact that household characteristics and socio-economic profile are poorer in Madhya Pradesh than in West Bengal. In West Bengal, the prevalence of acute respiratory infections has been found to be the second highest in India after Tripura.

During the National Family Health Survey, information on acute respiratory infections in children below five years of age was obtained from the mother of the child. The information collected during the survey included whether the child has had cough in the two weeks preceding the survey and was experiencing short and rapid breathing faster than usual or facing any difficulty in breathing and at the same time whether the child was suffering from a problem in the chest. Based on these questions related to breathing problems a child had, it was decided whether the child was having acute respiratory infections or not. In order to measure the differentials in the prevalence of acute respiratory infections in children, prevalence rates with respect to different background and household characteristics were computed for each region through bivariate analysis. Finally, binary logistic regression analysis was carried out to estimate the odds of the risk of acute respiratory infections in different social, economic and cultural settings.

Results and Findings

Characteristics of Households. The distribution of household by different household characteristics such as cooking fuel used, type of house, wealth index, and other items owned, etc. are given in table 1 for Madhya Pradesh, West Bengal and India. Both the states are high bio-fuel user states, although bio-fuel use is much higher in Madhya Pradesh (88 per cent) than in West Bengal (77 per cent). In case of type of fire place used (stove or chullah), most households use chullah / open fire. A very small proportion of households used stove in both the states and this proportion was lower than the national average of 5 per cent. In Madhya Pradesh, about 2 per cent of households used stove as compared to only about 1 per cent in West Bengal.

Over half of the households in both the states were living in semi-pucca houses (53 per cent in Madhya Pradesh and 52 per cent in West

Bengal). Pucca house dwellers were comparatively slightly less in West Bengal, than in Madhya Pradesh, although this proportion was more than the national average of 46 per cent in both the states. In nearly three-quarters of households in Madhya Pradesh, there were more than 3 persons sharing a room and this proportion was higher than that in West Bengal. Similarly, in less than half of the households in the two states, the kitchen was separate. This proportion, at the national level, was 57 per cent. The availability of electricity was more appalling in West Bengal where 57 per cent of households were relying on traditional means of lighting and endangering their lives. In Madhya Pradesh, by contrast, 70 per cent of households had electricity.

In case of other household items such as windows, chimney and mattress, the majority of the households in the two states were not having them. These house materials have direct health implications from the point of view of proper air circulation in the house (ventilation) and protection from insects/bacteria, etc. Only 1 per cent of households in Madhya Pradesh and 3 per cent of households in West Bengal had chimney (8 per cent in case of India). Likewise, use of mattress or having windows in the house also varied greatly. Mattress can prevent household members from being exposed to dampness of the mud floor or other effects of climatic variation through the floor and dusts. However, about 60 per cent of the households in Madhya Pradesh and 28 per cent households in West Bengal did not have windows. Windows are especially important in households using solid fuels for cooking and oil for lighting as they let the polluted air to go out of the house. Windows also act as a ventilator.

In terms of level of living, two-thirds of the total households in Madhya Pradesh and 61 per cent in West Bengal belonged to the lowest and second lowest wealth quintiles compared to the national average of 33 per cent. The proportion of households falling in the highest wealth quintiles category were about the same in the two states. However, this proportion was substantially lower than the national average of 24 per cent.

Prevalence of ARI among Children Aged 0-5 Years. The prevalence of ARI has been estimated to be very high among children aged less than two years as immunity is low at this age. In India, there is no significant disparity in the prevalence of ARI by sex, but in Madhya Pradesh, contrary to the West Bengal, male children are at higher risk than their female counterparts. Interestingly, West Bengal shows a prevalence rate three times higher than that of Madhya Pradesh. In both the states, rural

children are more vulnerable than urban children. At the national level also, prevalence of ARI in the rural areas is higher than that in the urban areas. The prevalence of ARI is much lower in children of highly educated mothers as well as in children belonging to high income households.

Table 2 does not depict any notable difference in the vulnerability to ARI by religion, but in West Bengal, Muslim children show higher risk as compared to the Hindu children. Also, Scheduled Caste children in Madhya Pradesh had the highest risk of ARI whereas in West Bengal, the prevalence has been found to be higher in Scheduled Tribes children and children belonging to other backward class categories. In the West Bengal, the smoking status of the mother does not seem to be a very important determinant of ARI in children but the impact is very much visible in Madhya Pradesh and in India. Prevalence of ARI also appears to be directly related to the level of income of the family. Children in lowest, second lowest and middle wealth stratum appear twice more likely to have ARI compared to those in the highest stratum in West Bengal. In Madhya Pradesh, the gap is even higher.

Prevalence of ARI by Household Environment Characteristics. Children living in the semi-pucca and kachcha houses had a higher prevalence of ARI as compared to children living in pucca houses (Table 3). The prevalence of ARI was higher in houses without electricity in West Bengal and India but not in Madhya Pradesh. Bio-fuel is one of the most important contributors to the risk of respiratory infections. Provision of separate room for cooking is essential to arrest the pace of transmission of ARI. Windows in the house and usage of mattress show their relation with control of diseases. Unlike West Bengal, in Madhya Pradesh, ARI is found to be more prevalent in households with more than three people sharing one room. Use of chullah and open fire for cooking appears to be dangerous for children in Madhya Pradesh. Children living in pucca households with windows and using clean fuel and mattress have been found to be having lower prevalence of ARI.

Results of Logistic Regression Analysis. Children living in households using bio-fuels for cooking have been found to be 19 times more likely to have acute respiratory infections in Madhya Pradesh ($p<0.01$) but only two times more likely in West Bengal compared to children living in households using clean fuels (Table. 4). Similarly, room density appear to be directly related to the risk of acute respiratory infections. In West Bengal, children living in kachcha houses are at much higher threat than those living in semi-pucca and pucca houses. Mothers'

smoking behaviour appears to increase the risk of ARI in the children by 22 per cent.

Use of electricity in the house appears to reduce the hazard of respiratory infections by 24 per cent in West Bengal. Having a separate room for kitchen and windows in the house shows a statistically significantly negative relation with the prevalence of ARI. Female children are 14 per cent less likely to be affected with ARI in Madhya Pradesh but they are relatively more vulnerable in West Bengal. In rural Madhya Pradesh, the risk of ARI among children is 14 per cent less than that in the urban areas but in West Bengal, the difference is statistically insignificant. Children aged at least 2 years are 31 per cent less likely to have ARI in Madhya Pradesh. This proportion is 34 per cent in West Bengal. Also, possessing and using mattress seems to reduce the vulnerability to ARI by 17 per cent.

Summary and Conclusion

The analysis affirms the relationship between household environment and risky individual behaviour with the prevalence of ARI among children. However, as other studies indicate, there are other importance factors for ARI such as genetic factors (family history of asthma), extreme temperature, high humidity, use of particular medicines, and keeping livestock in the premises of the house, etc., which are not addressed in this study due to data constraints.

Children less than 2 years are more likely to suffer from ARI than that of their older counterparts, since there is an inverse relation between the age of the children and the vulnerability to general diseases. The reason is immunity in children remains really low at the younger ages. There appears to be little effect by sex and place of residence on the prevalence of ARI. Bio-fuels, type of housing, crowding in the house, mother's smoking behaviour, type of fire used, etc, have impact on the respiratory health of young children. Use of chimney, mattresses and presence of windows in the house can contribute significantly in reducing the risk of ARI

The analysis suggests that examination of the prevalence of ARI from an epidemiological perspective should be a priority in research. There is a need to identify factors and their relationship with respiratory infections. Public health programmes in India should be more specific to address acute respiratory infections. There is also a need to emphasise upon a behavioural shift in terms of promoting the use of stoves and chimneys and making people aware about the importance

of improving the quality of housing including ventilation, separate kitchen, electricity, etc. Awareness about health impacts of sanitation and healthy personal lifestyles should also be disseminated among people as a long-run mechanism to reduce the prevalence of ARI among children and also among adults.

The present analysis has not been able to explain why despite poorer household environmental and socio-economic condition in Madhya Pradesh than in West Bengal, the later continues to have a much higher prevalence of ARI. Children in Madhya Pradesh appear to be relatively safer from the risk of respiratory infections than children in West Bengal. However, the study has been able to suggest some of the risk factors associated with acute respiratory infections in children below 5 years of age. These include: the age of the child (younger children are at higher risk), type of fuel used, housing materials, residence, education of the mother and wealth status. Preventive strategies need to address these socio-economic factors.

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Table 1
Selected household environment characteristics in Madhya Pradesh, West Bengal and India, NFHS-3 (2005-06)

		Madhya Pradesh	West Bengal	India
Fuel	Clean fuel	13.2	22.8	31.1
	Bio-fuel[$]	87.8	77.2	68.9
Fire	Stove	2.3	1.2	5
	Chullah/Open fire	97.7	98.8	95
Type of housing	Kachcha	25.9	19.0	13.8
	Semi-pucca	53.1	52.3	40.1
	Pucca	20.8	28.5	46.1
Persons per room	<=3	26.2	37.0	56.6
	>3	73.8	63.0	43.4
Separate kitchen	Available	40.3	45.6	57.1
Electricity	Yes	70.4	43.0	67.9
Wealth Index	Lowest	42.3	34.3	15.78
	Second	24.5	26.8	18.08
	Middle	13.4	17.7	20.39
	Fourth	11.5	13.7	22.16
	Highest	8.2	7.6	23.59
Chimney	Yes	1.4	3.3	8.4
Mattress	Yes	37.3	46.7	57.4
Windows	Yes	39.6	72.4	67.1

Note: # Electricity, gas, kerosene, coal and charcoal; $ Dung, shrubs, grasses, wood and others

Table 2
Prevalence of ARI (per 100,000 populations) by selected background characteristics in Madhya Pradesh, West Bengal and India, NFHS-3 (2005-06)

Background	Madhya	West Bengal	India
Age in months			
< 2	4190	15405	6918
>=2	3034	10652	4549
Sex			
Male	3747	11555	5599
Female	3146	13138	5221
Residence			
Urban	2613	10399	4831
Rural	3697	12838	5618
Mother's Education			
Illiterate	2544	12249	5475
Primary	5023	12587	6150
Secondary	4849	12570	5325
Higher	1424	8808	3372
Religion			
Hindu	3468	10989	4901
Muslim	3744	14484	8121
Caste / Tribe			
Scheduled Caste	4056	10020	4900
Scheduled Tribe	3688	15302	4246
OBC	3509	15886	5116
Others	2226	11861	6132
Mother's current smoking status			
Yes	5156	11275	6727
No	3181	12480	5270
Wealth Index			
Lowest	3850	13160	5460
Second	4306	12492	6362
Middle	3302	14309	5814
Fourth	1959	9836	4875
Highest	1196	7892	4001
Total	3451	12332	5418

Table 3
Prevalence of ARI (per 100,000 populations) by household environment characteristics in Madhya Pradesh, West Bengal and India, NFHS-3 (2005-06)

Household environment characteristics	Madhya Pradesh	West Bengal	India
Type of House			
Kuchcha	3058	12442	5413
Semi-pucca	4310	14151	6170
Pucca	1784	8972	4461
Electricity			
No	3272	13107	6327
Yes	3526	11304	4799
Cooking Fuel			
Cleaner fuel	1809	8706	4238
Bio fuel	3700	13403	5744
Separate room for cooking			
No	4184	12937	5064
Yes	3249	10468	4873
Cooking done under chimney			
No	12535	3705	5815
Yes	18527	0	4424
Any window			
No	13833	4011	5340
Yes	11760	2598	5467
Using mattress			
No	3970	13513	5704
Yes	2860	10352	5204
Persons per room			
<=3	2728	13566	5352
>3	3708	11609	5452
Type of fire			
Stove	165	13318	4100
Chullah/open fire	3694	12717	5766
Total	3451	12332	5418

Table 4
Odds ratios from logistic regression
analysis of characteristics associated with ARI

Covariates	Categories	Exp (B)	
		Madhya Pradesh	West Bengal
Fuel used	Clean fuel ®	-	-
	Bio fuel	19.44**	2.15**
Number of persons sharing a room	<=3 ®	-	-
	>3	1.19**	0.53**
Mother smoking	No ®	-	-
	Yes	0.78*	1.22**
Type of housing	Kachcha ®	-	-
	Semi-pucca	1.49	0.60**
	Pucca	1.06	0.25**
Electricity	No ®	-	-
	Yes	1.16	0.76**
Separate room for kitchen	No ®	-	-
	Yes	0.86**	0.84**
Sex of child	Male ®	-	-
	Female	0.86**	1.14**
Place of residence	Urban ®	-	
	Rural	1.12**	0.40
Age of the child	<2 years ®	-	-
	>=2 years	0.69**	0.66**
Windows	No ®	-	-
	Yes	0.86**	0.62**
Chimney	No ®	-	-
	Yes	0.00*	1.96**
Using mattress	No ®	-	-
	Yes	0.88**	0.78**

Note: ** *p<0.01 and* *p<0.05; ® = reference category

Perception of Child Health, Immunisation and Breast Feeding Practices among the Lodha Tribe of West Bengal

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Introduction

Investment in children is investment in human resources development which is crucial to the social and economic development of a nation (Saha et al 2003). Healthy children are the real wealth of any community (Narahari et al 2009). Government of India has been taking steps to strengthen maternal and child health services since First Five-year Development Plan (IIPS 2007). The initiation of Integrated Child Development Services (ICDS) added fillip to national child health services. However, these services are not uniformly utilised by all sections of the population particularly among the tribal population. Different studies have tried to establish that health status of the tribal population, by and large, is very poor (Basu 1987, Basu et al 1989, Basu 1990, Bardhan and Sinha 1989, Roy Burman 1986, Roy Burman 1990, Swain et al 1990, Mukherjee 1990, Mahapatra 1990, Rizvi 1986, Haque 1990). This possesses a potential challenge for the health system to improve the situation.

In the tribal population, child health care practices are not solely related with the biological understanding of the problem but are also influenced by their age old perception and cultural ways of approaches.

The pediatric health care practices have become vital issue for the developing countries where high foetal and child mortality have been reported. Studies (Ghosh 1989, Sinha and Pandey 1998) revealed that, for the baby, mother's milk is the easiest to digest than any other substance. It is safe and complete food for infants. Further, breast feeding has its socioeconomic, psychological, biological and

immunological advantages (Neetimakanti 1991). In spite of its importance, breast feeding is not practised uniformly in all groups and subgroups of the population and needs investigation and intervention.

Another basic child health care practice involves child immunisation. Universal immunisation of children against six vaccine preventable diseases (tuberculosis, diphtheria, whooping cough, tetanus, poliomyelitis and measles) is crucial to reducing infant and child mortality (IIPS 2007). Information on differences in vaccination coverage among different sections of the population are useful for programme planning and targeting resources to areas most in need. It is also useful for monitoring and evaluation of immunisation services. These services, again, remain grossly underutilised in most of the tribal areas.

There is a general feeling among the rural women that once the child is born there is no need for any checkup either for the mother or for the child except in case of serious problem only (Kapoor 1994). Information about routine post-natal care and child care is not readily available in many developing countries and there is still fairly limited survey experience (Graham et al 1995). Such studies are very few among the aboriginal population particularly primitive tribes and most of these studies have not been undertaken systematically. This prompted us to undertake this study among the Lodha tribe which is one of the primitive tribes of West Bengal. It may be mentioned here that no systematic study on perception and pattern of child health care has ever been conducted among the Lodhas. To the best of our knowledge, only one ethnographic study was conducted way back in 1952 by Bhowmick (1994). Therefore, an endeavour is made to study the perception on child health, utilisation of child immunisation services and pattern of breast feeding among the Lodhas of Medinipore district in West Bengal. It is believed that results of the study will be useful for micro-planning for improving the utilisation of post natal care particularly care related to child health care in the Lodhas.

Material and Methods

The survey was carried out in the year 1997. Lodhas of West Bengal are overwhelmingly conglomerated in the Medinipore district of the state (Risley 1891, Government of India 1951, Gupta 1959, Bhomick 1994, Das et al 1964, Singh 1994, Jain 1995). Hence, the survey was restricted to Medinipore district only. Official records suggested that the population of Lodhas was 36,069 in 1990. A sample of 500 ever- married Lodha

women in the age group 15-49 years was drawn from six blocks of the district proportionally to its size. The six blocks were selected randomly and they, together, constituted about 60 per cent of the total Lodha female population in the district. Villages predominated by Lodha were identified and listed. A sub sample of randomly selected women from 20 households per village was interviewed by canvassing a pre-designed interview schedule. The short fall in the sub sample of a village was adjusted from the next selected village. A total of 29 villages were covered in the study.

The People

The Lodha tribe, by and large, is culturally homogenous. Not much variation was found in the level of education and standards of living. Even though these variables are important, yet we have dropped them in our analysis and considered only occupation, duration of married life and index of religiosity as the background variables, Occupation was broadly categorised into two categories depending on the subsistence levels of the family and activities during the major part of the year. The two occupational categories viz., 'Agricultural' refers to cultivating one's own land while 'Gatherers' subsists on collection and selling of forest produce. The index of religiosity was computed by using scaling technique and for this purpose following questions were asked to the respondents: believe in god; observe religious symbol; pray daily; visit religious places daily; impart religious education to children; believe in hell and heaven and Lodha ritual superior than others. The responses for each statement were recorded either Yes=1 or No=0. Test of significance was done by computing Cramer's value (Hadderson, 1987).

Information on child health care perception of the respondents was also obtained by asking their views on the following statements related to superstition about child heath care:

- Angry deities punish wrong doers in the form of disease to their children,
- Sorcerers and witches are responsible for all type of incurable diseases among the children in the society,
- Childhood diseases are also caused by spirit of intrusion of supernatural object into the body of the child, and
- Children lose equilibrium due to entry of excessive heat or cold into their body.

Thereafter, arbitrary score was assigned to perceptions about each of the above statements and thus child health care perception with

respect to superstition was worked out as low, medium and high according to the score secured by each women in the following the way:

1. Low superstitious perception was assigned to a woman who secured a total score 7 or less;
2. Medium superstitious perception was assigned to a women who secured a total score 8 to 10, and
3. High superstitious perception was assigned to a women who secured a total score 10 and above.

Once the scoring was done in the above manner, the child health superstitious perceptions were then examined with respect to their selected background characteristics.

Findings and Discussion

Perception on Child Health. Table 1 shows the association between perceptions about child health and some background variables. It may be seen from the table that older women were relatively more superstitious than younger ones and the association between women's age and their superstitious belief on child health was significant with Cramer value of 0.098, $p<0.05$. The same was true with the educational status of the women with Cramer's Value of 0.272, $p<0.001$. It is obvious that education of women significantly influences the superstition pertaining to child health among the Lodhas.

As regard occupation of women, 'gatherers' were found to be highly superstitious compared to `others' (housewives and those engaged in agricultural activities). The difference between the women having highest and lowest child health perception score among the 'gatherers' was the highest compared to other categories. This could be one of the important factors acting as barrier in the utilisation of health services among the 'gatherers'. The association between the perception of the child health and occupation of the respondents was found to be highly significant with a Cramer's Value of 0.183, $p<0.001$.

Out of 491 ever married women who gave at least one birth, 58 per cent were having 1-2 children while the rest were having 3 or more children. It may be seen from the table that women with at least 3 children were more superstitious despite the fact that they had long exposure to child bearing and rearing practices.

The association between the perception about child health and index of religiosity was found to be highly significant with a Cramer's value of 0.264, $p<0.001$. It was found that more a woman was religious, the higher she was superstitious about child health.

Awareness and Utilisation of Child Immunisation Services. The objective of immunisation is to prevent the child six widely common diseases by developing body resistance. In India, the Expanded Programme on Immunisation (EPI) was launched in 1978 with the objective of reducing morbidity and mortality due to diphtheria, pertussis, tetanus, poliomyelitis and tuberculosis by making vaccination services available to all eligible children and pregnant women by the year 1990. Measles was included in the programme in 1985-86 when it was expanded to Universal Immunisation Programme (UIP) with the target of achieving one hundred per cent immunisation coverage of infants by 1995. It also aimed at achieving self sufficiency in the production of vaccines.

In view of the importance of child immunisation, an attempt has been made to study the knowledge and utilisation of child immunisation services among the Lodhas. The mothers interviewed during the survey were asked if they had ever heard about the different vaccinations and if their youngest child was under five years of age had received any injection or drop to protect them against the preventable childhood diseases. The information was collected for the youngest child only to minimise the error due to recall lapse. Since vaccination card was not available with majority of the mothers, the type and dose of the vaccine administered to the youngest child was probed in the following way:

(i) If there was any scar mark on the left arm of the child, the probing was done for BCG vaccination.
(ii) If any injection was given to the child after 6 weeks of birth, probing was done for DPT vaccination.
(iii) If three oral doses were also given along with the injection, probing was doe for oral polio vaccination.
(iv) If any injection is administered during late infancy, probing was done for measles vaccination.

It was found that an overwhelming majority of the respondents (86 per cent) were aware of OPV, followed by BCG (67 per cent), DPT (48 per cent) and measles (42 per cent). This high level of awareness regarding immunisation among this primitive community could be because of the IEC activities. The data in detail is presented in Table 2

Further, when mothers were asked about the necessity of child immunisation, about 74 per cent agreed that immunisation could save the child from childhood morbidities. However, as regards utilisation of the immunisation services, only 35 per cent of the ever married women who had given at least one birth had their youngest child fully

immunised. A sizeable number of women surveyed (21 per cent) did not immunise their youngest child at all (Table 3).

Breast Feeding Practices. Breast milk contains at least six infective agents against some of the common illness of infancy (Caldwell 1981). During the first few months of life, breast milk acts as the best possible protection and balanced nutritious food for the health and growth of the child. Breastfeeding also serves as a natural contraception because of prolonging of the lactational amenorrhea and hence the birth interval (Carneiro 1988, Gangadharan et al 1982).

Breastfeeding was found to be universally practised by the Lodha women. The perceived mean duration of breast feeding was estimated to be 26.4 months against 42.6 months of actual duration of breastfeeding for the youngest child. This duration was much higher than the national average of 24.4 months and 32.8 months for West Bengal (IIPS 1995). Gangadharan (1982), in his study among the Chenchu, a food gathering tribe of Andhra Pradesh, estimated a mean duration of breastfeeding of 20.64. It appears that the longer duration of lactation among the Lodhas was not just because of social and cultural practices but also because of the lack of alternative source of food supplementation to children.

It is recommended that the first breast milk should be given to every newborn children because it contains colostrums which provide natural immunity and important nutrients to children. However, a substantial majority (64 per cent) for the mothers in India squeeze the first milk before they begin breast feeding (IIPS,1995). Among the Lodhas, only 16.0 per cent of the women breast fed their babies immediately after birth and 40 per cent breast fed their babies the next day. This indicates that there is a need to educate mothers regarding the importance of early initiation of breast feeding. It was also found that majority of the Lodha women (62 per cent) breast fed their infants 8 or more times a day. Gangadharan and others (1982) have also estimated that Chenchu women fed their infants, on an average, fed their infants 9.7 times a day. At the same time, the sex difference in the frequency of breastfeeding per day was not found to be statistically significant (Cramer's value = 0.087, $p>0.1$) (Table 4). Similarly, although, girls enjoyed a larger duration of breastfeeding compared to boys but the difference was not found to be statistically significant (Cramer's value = 0.115, $p>0.1$) (Table 4). However, the study conducted by Carneiro (1988) among the Warli tribe observed that male children were breastfed longer period as their welfare was perceived more important.

Conclusions

To conclude, the study points out to the fact that due to wrong perceptions of child health care among the Lodhas, majority of them do not understand the importance of the utilisation of the available child health facilities and thus make children vulnerable to childhood morbidities and even death. There is need to change this perception in the interest of improving the child survival, health, and growth. Regarding child immunisation services, majority of the respondents were aware of it but utilisation of the full services was meager and the drop out was quite high. This indicates that there is a need for community specific IEC programme on immunisation to bring about a behavioural change for better utilisation of the services in future. Breast feeding patterns indicate that it was universal among the Lodhas. A longer duration of breast feeding is a good indication but the Lodhas need to be educated regarding the early initiation of breast feeding and the colostrums should not be discarded.

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Table 1
Superstitious belief on child health perception by background characteristics

Background characteristics	Base	Number of respondents (%)		
		Superstitious perception on child health		
		Low (4-7)	Medium (8-9)	High (10+)
Age				
15-24	1.8e+08	52 (29.7)	58 (33.1)	65 (37.1)
25-34		58 (27.6)	69 (32.9)	83 (39.5)
35-49		17 (14.8)	42 (36.5)	56 (48.7)
Total		127	169	204
Education				
Illiterate	344156	66 (19.2)	109 (31.7)	169 (49.1)
Literate		61 (39.1)	60 (38.5)	35 (22.4)
Total		127	169	204
Occupation				
Others	195305	63 (32.3)	77 (39.5)	55 (28.2)
Gatherer		64 (21.0)	92 (30.2)	149 (48.9)
Total		127	169	204
No. of children born				
1-2	283208	76 (26.9)	100 (35.3)	107 (37.8)
3+		48 (23.1)	66 (31.7)	94 (45.2)
Total		124	166	201
Index of religiosity				
Low	1.1e+08	52 (47.7)	23 (21.1)	34 (31.2)
Medium		70 (25.0)	112 (40.0)	98 (35.0)
High		5 (4.5)	34 (30.6)	72 (64.9)
Total		127	169	204

Table 2
Distribution of the respondents according to awareness on different immunisation scheme

Name of the Vaccination of different Immunisation Schemes	No. of Respondents(%) N=491 (Multiple responses)
OPV	420 (85.5)
BCG	328 (66.8)
DPT	235 (47.9)
Measles	207 (42.2)

Table 3
Distribution of the mothers according to their perception and utilisation of immunisation services

I. Perception: immunisation is necessary to save the child during infancy	No. of Respondents (%) N=491 (Multiple Response)
Agreed	363 (73.9)
Neutral	41 (8.4)
Disagree	96 (19.6)
II. Utilisation of the immunisation services	**No. of women who utilized the immunisation services**
Fully vaccinated	173 (35.2)
Partially vaccinated	215 (43.8)
Not vaccinated	103 (21.0)

Note: Only 491 ever married sample women in the reproductive age group gave at least one birth at the time of survey.

Table 4
Percentage distribution of the women according to the frequency of breast feeding and duration of breastfeeding to their last child by sex

Sex of the last child	Frequency of breast feeding/day No. of Respondents (%)			Total
	Up to six times	Seven to eight times	Nine or more times	
Male	53 (19.1) (57.6)	62 (22.4) (64.6)	162 (58.5) (53.5)	277 (56.4)
Female	39 (18.2) (42.4)	34 (15.9) (35.4)	141 (65.9) (46.5)	214 (43.6)
Total	92 (18.7)	96 (19.6)	303 (61.7)	491 (100.0)

Sex of the last child	Duration of breast feeding in feeding (in months)				Total
	12	13-24	25-36	37+	
Male	64 (23.1) (68.1)	86 (31.0) (54.1)	44 (15.9) (52.4)	83(30.0) (53.9)	277 (56.4)
Female	30 (14.0) (31.9)	73 (34.1) (45.9)	40 (18.7) (47.6)	71 (33.2) (46.1)	214 (43.6)
Total	94 (19.1)	159 (32.4)	84 (17.1)	154 (31.4)	491 (100.0)

Successful Health and Nutrition Programme for Child Survival in Andhra Pradesh

M Ubaidullah
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Introduction

The focus of this paper is on the successful provision of integrated comprehensive health services - general health, reproductive and child health, prevention of Sexually Transmitted Infections (STI) including HIV/AIDS, and family planning - to Lambadas, a tribal community living in the rural areas of Khammam District in the state of Andhra Pradesh in India. The word Lambada is derived from the word Lamba which means tall (Census of India 1961). The Lambadas seems to have been one of the ancient tribes in India since their name is found in old literary works like *Dasakumara Charitam* written by Dandi in 11th and 12th Century. They are supposed to be the descendent of original Aryan gypsies or Roman Banjaras of North-west India whose descendent are also found in various parts of the South Europe, Central Asia and America. Lambadas were chiefly traders. They are also known as Sugalis or Banjaras. There are many mythologies regarding the origin of Lambadas. (Thurston 1975). Based on these mythologies, Lambadas also consider themselves as Kshatriyas (Kamala Manohar Rao 1950). Many scholars like Thurston, Kamala Manohar Rao, Siraj-Ul-Hassain, Aiyer, etc. opine that Lambadas were chiefly traders dealing with salt or rice or betel nut. The Lambadas are aware that their forefathers were migrants from the Deccan with the Moghul armies which had been linked with Asaf Jah the Vazir of Shajahan. It is also traced out in the history that after the conquest of Warangal by Mohammed Tughlak, most of the Lambadas stayed in Warangal and started trading in the

south. Marriages among the Lambadas are based on the principles of community endogamy and the clan exogamy.

By and large, the Lambadas are a beautiful tribe. They are basically intelligent, faithful, honest and brave. Once they are gained over, they remain as devoted followers. A typical Lambadas is dolichocephalous, with oval face, black or brown eyes, long hair and strait nose (Nanjundayya and Iyyer 1928). Both men and women are strong and are capable of enduring long and fatiguing marches. They still retain their fair complexions despite the beastly summer of the Deccan.

Since the Lambadas are nomadic, they live in detached clusters of rule huts called "thandas" at some distance from established villages. They eat all kinds of fowls and pork. Lambadas feel that the institution of marriage is used as social mechanism to create and foster social solidarity and hence they have supposed the marriage institution. The dress and ornaments of Lambadas denote their utility and importance and protects them from all types of climatic disorders. These people can easily be identifide by the traditional dress and ornaments. Some Lambada women treat their dress and ornaments with their social values and they also preserve them as their ancestral property. Some of the old Lambadas are of the view that tattooing gives relief from the pain in the body and joints and protects from the evil looks of others. Both male and females are addicted to heavy drinking. Their culture regulates the mode, kind and quantum of drinking. Lambadas have adopted many festivals of Hindus. They have shown greater interest in preserving and continuing their traditional religious beliefs and festivals. With the exception of these festivals, under normal conditions of life, there is a very little spiritual or devotional activity in the community. Poor health, especially, diseases are interpreted in terms of supernatural interferences, and are sought to be remedied by magico-religious procedures and witchcraft.

The Lambadas are mostly illiterate. They live under abject poverty conditions. Child marriages are common among them. Pre-marital and extra-marital sexual relations and liquor addiction are also quite common among both men and women. Usually, Lambadas do not seek medical help whenever somebody falls ill in the family. They approach an allopathic doctor only when the condition of the patient becomes serious. A Lambada couple, on average, has 6-7 children. Only less than one third of Lambada children (30 per cent) go to school. The vast majority of Lambada couples do not practice family planning; the couple protection rate is only around 22 per cent. Most of the deliveries

(80 per cent) take place at home. Only one fourth of them (25 per cent) make use of hospital facilities during pregnancy and delivery. The incidence of HIV among the Lambada men and women is found to be very high (6 per cent) as against the national (0.91 per cent) and state (2.75 per cent) averages. Infant and child rate and maternal mortality ratio in Lambadas have been found to be well above the national and state averages (Table 1). Similarly, mother-to-child transmission of HIV has been found to be very high in Lambadas. Almost three-fourth of new born are low birth weight babies, weighing less than 2.5 kgs. Severe malnutrition has been found to be widely prevalence in infants, young children, pregnant women and lactating mothers.

Against the above demographic and health backdrop, a comprehensive health package was designed to improve the general health status, prevent the spread of STI/HIV and mother-to-child-transmission (MTCT) of HIV, bring down maternal, infant and child morbidity and mortality and improve the nutritional status of the Lambada community. The comprehensive health package so designed was implemented by a non government organisation with the help of trained social workers. This organisation has been running a hospital/clinic. The programme is still in operation.

Methods and Materials

Khammam is a socially and economically background district in Andhra Pradesh. It has the highest proportion of Scheduled Tribes population in the state. For the present operational research study, a cluster of 100 villages with a population of about 2,00,000 was selected. The Lambadas constituted majority of the population in the selected villages. Men and women in the selected villages were encouraged and persuaded to make use of services being provided under the programme in the villages and at the hospital/clinic. The programme was carried-out with the help of trained social workers, paramedics and a doctor at the village level. At the hospital/clinic level, paramedics, social workers and doctors provided a range of health care and other supportive services to the Scheduled Tribes people in a very friendly and cordial atmosphere.

Social Workers and their Role. In all, 10 social workers were appointed and they were trained for a period of two months well before the commencement of the programme. All of them were post-graduates in Social Work and had a minimum of five years experience in conducting similar programmes. They were trained thoroughly about

STI/HIV/AIDS, maternal and child health, family planning, etc. as well as in the use of different educational techniques to bring about attitudinal change among the Lambadas regarding pre-marital and extra-marital sexual behaviour, if any, and use of condom for safe sex. They were also trained in rapport building and counselling techniques etc.

Social workers involved in the programme performed multiple roles. Initially, they built-up very good rapport with the Scheduled Tribes community using counselling techniques. The counselling sessions were conducted in Telugu, the local language which the Lambadas understood easily. Subsequently, they judiciously used other educational strategies (posters, group discussions, meetings and counselling) to provide scientific knowledge to the respondents thus sharpening their awareness about health and family welfare related issues. The importance of using condom to avoid the risk of HIV/AIDS infection and the correct procedure to use condom was also explained to them. These counselling sessions contributed significantly in enhancing the knowledge of Lambadas about STI/HIV/AIDS, maternal and child health, nutrition, family planning, use of condom for safe sex, the importance of attending the MCH clinic regularly for pre-natal, natal and pos-natal care and Voluntary Counselling and Testing (VCT) of HIV. The counselling programme had the desired impact and the Lambadas started attending hospitals whenever they fell ill. The pregnant women learnt to visit the MCH clinic regularly. The HIV positive pregnant women not only visited the MCH clinic regularly but also modified their infant-feeding practices and had deliveries in the clinic. Some of the HIV positive pregnant women accepted medical termination of their pregnancy and a few opted for family planning after delivery. The impressive success achieved in the prevention of HIV transmission was largely due to the dedicated efforts of the social workers in conducting the intervention programmes. They richly deserve thanks of all concerned.

Programme interventions. The programme included a range of interventions of varied nature. These interventions are discussed below at some length:

Community Education and Mobilization. Social workers initiated the community education programme on STI/HIV to create a clear understanding of the magnitude of the problem in a holistic way, especially among the Lambadas and in Khammam district and Andhra Pradesh, in general. The programme was organised for a period of six

months in all the 100 villages covered under the programme and covered such issues as high infant and child mortality, nutrition, etc. As the result of the programme, people living in these villages were able to get a clear understanding of the problems of STI, reasons for high infant and child mortality and mortality, importance of nutrition, availability of health facilities, etc. Posters were put up in all villages explaining STI, family planning, maternal and child health, balanced diet, immunisation etc., to create mass awareness on all the programme components.

Information, Education and Communication. A variety of information, education and communication (IEC) activities were organised in villages for about one year through group discussions, meetings, distribution of literature and pictures, folk media, one-to-one meetings and counselling. As part of information, education and communication programmes, the Lambadas both men and women were explained about prevention of mother-to-child Transmission of HIV, signs and symptoms of STI/HIV, its dangers, the prevention of STI/HIV, importance of treating STI, availability of health services, importance of immunisation of pregnant women, infants and children, importance of nutrition and applied nutrition programme initiated in the community, need, importance and advantages of family planning and small family. These activities were directed primarily towards enhancing the knowledge of Lambadas community about critical issues related to their health.

Enactment of Plays. Selected folk were trained in enacting plays in the villages to communicate messages on STI, methods of family planning, advantages of family planning, utilisation of maternal and child health services, applied nutrition programme etc.

Folk Media. Traditional folk media is still very popular in rural areas of India. A variety of folk media programmes were organised in the project villages to provide information about availability of general health services, maternal and child health and applied nutrition programme for women and children. The folk media messages were well received by the people in rural and semi-urban areas. They were found to be an inexpensive way of reaching the people at large. Folk media was also found to be a very useful tool to have an immediate impact on the audience.

Distribution of Literature on Maternal and Child Health/STI and Family Planning. Literature with pictures on STI, its dangers, its symptoms, its mode of transmission, spread of the disease, its prevention, compulsory

treatment of STI, to men and women in these villages. Also, pamphlets explaining the importance of the utilisation of maternal and child health services and places where maternal and child health services were available were also distributed.

Group discussions. Group discussions for the young married men and women were organised by the Social Workers to discuss symptoms of STI, spread of the disease, disease prevention, compulsory treatment of STI, etc. In addition, the need and importance of family planning, concept of small family norm, availability of maternal and child health services, need to make use of maternal and child health and applied nutrition programmes services were also discussed. All explanations were given through pictorial illustrations to the extent possible. The participants were given ample opportunity to discuss their doubts with regard to STI and all other related issues such as MCH services, applied nutrition programme etc.

Meetings. In village under the project, a meeting was organised once in two months. The meetings were arranged generally during the night, between 7.00 to 9.00 PM which was very convenient for the villagers. The date and venue of the meeting was informed well in advance to men and women of each village and were requested to make it convenient to attend them. In these meetings, villagers were explained in detail about the prevalence of high maternal, infant and child morbidity and mortality in the tribal communities, the need and importance of family planning, the concept of small family norm, the availability of reproductive and child health and applied nutrition programme services. Men and women who attended these meetings were also given equal opportunities to discuss frankly their sexual, health and other related issues and problems and all their doubts were clarified.

One-to-one meetings. Usually, several rural people both men and women feel shy in the village meeting and group discussions to raise their doubts with regard to STI, family planning and other related issues. Such people prefer to have personal meeting. For such people, social workers and paramedics working under the project arranged one-to-one personal meeting to provide the desired information, to clear the doubts and to bring about the behavioural change. These meetings were found to be very much effective in infusing a positive orientation in the people about issues related to health and survival of children and women.

Involvement of father in maternal and child health programme. Traditionally, in the Indian society, whenever a woman becomes pregnant, it is the elderly women who used to accompany her when she goes to a doctor for availing the maternal and child health services. The situation appears to be changing in the urban areas as men are increasingly found to accompany women to the hospital. However, this change is rarely visible in the rural areas. In order to promote involvement of the father or the husband, social workers and paramedics emphasised the role and contribution of men in reproductive health and family planning issues. This emphasis has resulted in a positive attitude in men about health related problems of women. Men have slowly started accompanying their wives whenever they to go to the clinic for ante-natal check up. They have been found to support their wife to adopt family planning, encourage them to have adequate nutrition during pregnancy, and provide the needed physical, financial and emotional support during pregnancy, at the time of delivery and during the post-partum period. Men who were more involved in the health of their family members were not only able to provide better health to them but also had close relationship with all the family members.

Pre-natal, Natal and Post-natal Care at the Doorstep of the People and at the Clinic. Pre-natal, natal and post-natal care services are provided both at the clinic and in the village. All pregnant women are advised to visit the hospital for routine check-up. Pregnant women who cannot attend the hospital and who intended to have services at their residence were taken care off by the paramedics. However, HIV-testing was done only in the clinic. If the paramedics felt that a particular case was to be seen by the doctor, she was referred/taken to the hospital. Further, all the HIV-positive pregnant women were strongly advised to have deliveries in the clinic. If at all, any woman expresses her inability to have delivery in the clinic for one reason or the other, then the local trained dais/paramedics conducted the delivery and administered Nevirapine both to the mother and the infant at the time of delivery at their residence to prevent mother-to-child-transmission of HIV.

Prevention of Mother-to-children Transmission of HIV. All the pregnant women were screened for their HIV-status. Women, who were found to be HIV positive were given single oral doses of Nevirapine at the time of delivery along with the new born to prevent mother-to-child-transmission of HIV. In case of hospital-based deliveries, the staff at the hospital administered the drug to both the

mother and the new born. The few HIV-positive home deliveries were attended by traditional birth attendants/paramedics who were trained in conducting deliveries and a single oral dose of Nevirapine was kept ready for self-medication at the onset of labour and to the infant within 72 hours of delivery.

Applied Nutrition Program for Pregnant and Lactating mothers and Children. Nutritious food was provided to pregnant women, lactating mothers and children in the community as part of the applied nutrition programme through paramedics, social workers and self-help groups in every village to enhance their nutritional status.

Food Supplementation to Under-weight Women. The criteria was weight for age and weight for height. To identify the undernourished potential mothers, the body mass index (BMI) was used for girls between 13-20 years of age. All girls having a BMI less than the 10^{th} percentile curve were considered as undernourished and were provided nutritional supplements. Similarly, children aged 5-14 years and having a BMI less than 5^{th} percentile curve were classified as under nourished and were given nutritional supplements.

Food Supplementation to Pregnant Women. All pregnant women were given food supplementation for a period of eight months equalling 4 kgs of nutrition powder per month. In addition to this, milk, eggs, vegetables, etc. were also provided.

Food Supplementation to Lactating Mothers. Each lactating mother was given a food supplementation equivalent to 13,500 calories per month during the lactation period – equalling 4 kgs nutrition powder per month, out of which 2 kgs nutrition powder was cooked and given. In addition, milk, eggs, vegetables were provided free of cost.

Weaning of Infants between 4 Months and 1 Year. Infants were given 1 kg of cereal food made of ragi, Bengal gram and broken dried gram per month from the fourth month to one year, as weaning food.

Supplementary Nutrition for Children of 1-2 Years of Age. Children of 1-2 years of age were given 1 kg of dried nutrition powder mixed with grains such as ragi, Bengal gram and broken dried gram in equal proportion. The powder was cooked and served to the children by women's groups.

Supplementary Nutrition for Children between 2-5 Years. Children aged 2-5 years were given calorie supplementation made of boiled and salted Bengal gram/green gram at the rate of 1 kg for the 2 year old, 2 kg for 3 year old and 3 kg for 4 year old in all nursery schools in the study area covering 100 villages.

Supplementary Nutrition for Severely Malnourished Children aged 5-14 Years. About 87 per cent of the children in this age group were undernourished. On average, a child in this age group needs 2,500 calories per day. Hence, supplementary nutrition was given to children. It was estimated that they needed 15,000 calories per month. Accordingly, a total calorie supplementation of 15,000 calories which was rounded to 2 kgs of nutrition powder and groundnut. The nutrition powder consisted of Bengal gram and jaggery mixed with roasted groundnut.

Micronutrients for Infants, Children, Pregnant Women and Lactating Mothers and Undernourished Mothers. In addition to food supplementation to combat protein-calorie under nutrition, micro-nutrients were given to all infants, children, pregnant women, lactating mothers and under nourished mothers. Children who were below one year were given Vitamin A, B and D in the form vitamin drops. Children between 1 and 15 years were given 50,000 units of Vitamin A, every three months. Children between 2 and 5 years of age were given iron supplementation every month. They were also given, once a week, ginger and groundnut sweets to add oil content to their food. In addition, calcium supplementation was also given (half a tablet) daily. Each pregnant woman was given one iron tablet and one B-Complex tablet per day. On the other hand, each undernourished mother was given one iron capsule and one multi-vitamin tablet daily while . Lactating mothers were given one iron tablet and one calcium tablet daily.

Immunisation of Pregnant Women, Infants and Children. Facilities were made available both at the village and the clinic. At the clinic, immunisation was given on every Monday and Tuesday and in the villages it was on every Thursday and Friday. All the pregnant women, infants and children were immunized as per the immunisation schedule. Every pregnant woman, infant and child were given an immunisation card to ensure that all of them were immunized as per the schedule without fail. The paramedics also maintained a record of pregnant women, infants and children and kept their track and saw to it that all were immunized as per the immunisation schedule.

Medical Termination of Pregnancy. Some of the pregnant women having less than 20 weeks of pregnancy who wanted to abort the pregnancy were advised the medical termination of pregnancy by the doctor. The grounds for advising medical termination of pregnancy included:

1. Women who were anaemic, under weight and were not capable of bearing the pregnancy.
2. Women who were HIV-positive and who had more than two children.
3. Women who had more than four children.

Immunisation Schedule

Age	Vaccine
Pregnant women	TT 2 doses
Birth	BCG (injection) and 0 dose polio
6 weeks	1st dose DPT (injection)
	1st dose oral polio vaccine (drops)
	1st dose hepatitis B vaccine (injection)
10 weeks	2nd dose DPT (injection)
	2nd dose oral polio vaccine (drops)
	2nd dose hepatitis B vaccine (injection)
14 weeks	3rd dose DPT (injection)
	3rd dose oral polio vaccine (drops)
	3rd dose hepatitis B vaccine (injection)
9 months	Measles vaccine (injection)
18-24 months	Booster dose of DPT & OPV
5 years	DT (injection)
10 years	TT (injection)
16 years	TT (injection)

Results

The result of the above interventions was a marked improvement in almost all dimensions of the demographic and health situation in Lambada community as may be seen from table 2. These achievements are discussed below:

Utilisation of Health Services. In the year 2003, only 1265 women of the Lambada community utilised the available maternal and child health services in the project area. As the result of programme, this number increased to 4903 in 2007 which shows the effectiveness of the interventions under the programme.

Perinatal Transmission of HIV. Before the commencement of the programme, perinatal transmission of HIV was estimated to be as high as 4 per cent in the year 2003. This proportion came down to 1.4 per cent in 2007 as the result of very intensive counselling programme.

Infant and child mortality. The infant mortality rate was 102/1000 live births in the year 2003. By the year 2007, the infant mortality rate reduced to 43/1000 live births. Similarly, the under 5 mortality rate decreased from 123 in 2003 to 73/1000 live births in 2007.

Maternal mortality. Before the commencement of the programme maternal mortality rate was 580/1,00,000 live births due to poor nutrition, poor health, under-utilisation of health facilities, poor sanitation, frequent child births, under weight etc. As the result of programme interventions, maternal mortality decreased to 392/1,00,000 live births in 2007.

Institutional deliveries. Initially, only about one-fourth of Lambada women delivered in the hospital. As the result of programme interventions, the proportion of institutional deliveries increased to 84 per cent in 2007.

Low birth weight babies. The proportion of low birth weight babies came down from about 70 per cent before the start of the project to only 23 per cent in the year 2007.

Under-weight children. Like the proportion of low birth weight babies, the proportion of children having low weight for age decreased from 60 per cent in 2003 to 17 per cent in 2007.

Conclusions

The achievement of the programme clearly shows that it is possible to bring down maternal, infant and child mortality and morbidity to very low level with the programme interventions initiated for the tribals. Similarly, institutional deliveries became popular among the tribal community. The percentage of low birth weight babies and under-weight child born to these tribes has decreased considerably. In Madhya Pradesh a large percentage of tribals are living. Their health status is very poor Thus, the programme intervention are worth replicating in all the tribal areas where similar situation exist.

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Table 1
Key demographic and health indicators in Lambadas as compared to Andhra Pradesh and India, 2003.

Indicator	Lambadas	Andhra Pradesh	India
Infant mortality rate	102	52	62
Under 5 mortality rate	121	98	91
Maternal mortality ratio	540	420	436
Mother to child transmission of HIV	4	2	0.9

Source: NFHS-3

Table 2
Achievements of the programme.

Utilisation of Health Services	2003	2004	2005	2006	2007
Maternal and child health	1265	2872	3896	4658	4803
Prenatal transmission of HIV	4	4	3	2	1
Infant mortality	102	94	89	54	43
Under 5 mortality	123	116	109	87	73
Institutional deliveries	23	38	45	70	84
Low birth weight babies	70	65	59	26	23
Underweight children (0-5) years	60	53	41	21	17

Infant Mortality in the Gond Tribe of Raisen District, Madhya Pradesh

Ajay Kumar Gharami

Introduction

"Children's health is tomorrow's wealth" is a very well known saying. In reality, birth of a child occupies a special position in people's life as children are loved all over the World. As per WHO (1981, 1990), infant mortality rate is an accepted global indicator of health and socioeconomic status of the population. Infant mortality has long been used as a marker of the socio-economic development of a nation (Gubhaju et al 1992) and a reliable indicator of health status and well-being of children.

Unfortunately, a large number of children die every year in India due to various kind of disease conditions. In order to prevent these premature deaths, a number of programmes have been implemented in India over the last two decades. These include Child Survival and Safe Motherhood Program (CSSM), Reproductive and Child Health Program (RCH). At present, Integrated Management of Neonatal Childhood Illness (IMNCI) approach is being implemented under the National Rural Health Mission to address the problem of infant and child mortality. However, irrespective of these interventions, the situation related to infant's health remains a major concern and a daunting challenge. There has been a decrease in the infant mortality rate in India but this decrease has been slow by international standards. Analysing the slow decrease in India's infant mortality rate, Sandhya (1991) has opined that there are certain socio-cultural factors which play some important role in determining the level of infant mortality rate

including such factors as public health engineering, control of certain communicable diseases such as malaria, cholera, etc. Sandhya (1991) has also observed that one hardly finds details on socio-cultural and demographic characteristics of infant deaths from secondary sources of information.

It is well established that many a social and biological factors are associated with survival and well being of the child during infancy and early childhood. The determinants of infant mortality, however, vary between regions, between cultural groups, and also between geographical regions of different economic status. However, very few anthropological studies have been carried out on this aspect in tribal population in Madhya Pradesh (Basu 1989, Talwar 1988, Sharma 1999, Adak et al. 2004). Tribal population in Madhya Pradesh constituted more than one fifth of the state population at the 2001 population census. In the present paper, we make an attempt to analyse infant mortality and analyse its key determinants in the Gond Tribe of Raisen District of the state.

Material and Methods

The present study focuses on the Gond tribe residing in villages surrounding Bhimbetka in district Raisen of Madhya Pradesh. The information used in the present analysis was derived from a survey of all Gond households in 13 villages in the area. An exhaustive schedule was prepared for data collection. The survey was carried out during the months of January through June in the year 2007. It covered 370 ever pregnant Gond tribe women from 13 villages. The present analysis is based on the information available through these 370 ever pregnant women.

The Gond in Madhya Pradesh speaks the 'Gondi' dialect, which belongs to the Dravidian family of languages. Though, the traditional marriage i.e. marriage by capture is not prevalent among them yet, cross-cousin marriage, marriage by exchange and marriage by service is prevalent in the Gond tribes. The primary source of livelihood for the Gond tribes is agro-forestry. The Tribe is organised into a number of clans and members of each clan worship their own deity described as 'persa pen' (Adak et al., 2003).

Results

The survey has revealed that the Gond tribes live in abjectly poor conditions. In more than 63 per cent of the Gond families surveyed, the

head of the family earned their livelihood as daily wage labour with the result that more than 82 per cent of the Gond families surveyed were low income families. Poor economic status of Gond families was found to be associated with mass illiteracy. More than 83 per cent of women and than 64 per cent of men in the surveyed population were illiterate. In the demographic context, the population of Gond tribes surveyed may be classified in the very early stage of demographic transition with high levels of fertility and high levels of mortality, especially infant and child mortality. Teenage pregnancies were quite common in the population surveyed which may be one reason for very high number of infant deaths.

The infant mortality rate (IMR) in the surveyed population is estimated to be 129 per 1000 live births which is higher than the state (72 per 1000 live births) and national (55 per 1000 live births) averages (Government of India 2007). Infant mortality rate in the Gond tribe has also been found to be higher than that for the tribal population in the state as a whole estimated on the basis of the information available through the 2001 population census.

Because of the small number of ever pregnant women covered in the survey, it is not possible to estimate infant mortality rate for different subgroups of the population. However, in order to get some idea of differentials in infant mortality in the Gond tribe, we have based the analysis on the basis of the proportion of children dead (CD) out of total children ever born (CEB). It is well known that it is possible to estimate the infant mortality rate from the proportion of children dead if the information is available by the age of the mother.

Table 1 summarises the variation in the proportion of children ever born dead at the time of the survey (CD/CEB) by six independent variables used for the analysis. This variation is discussed at some length below.

Mother's Education and Infant Mortality. The proportion of children ever born dead has been found to be very high among illiterate mothers (14.90 per cent). By contrast, the proportion of children ever born dead has been found to be very low in mothers having at least primarily level education (4.50 per cent).

Father's Education and Infant mortality. Like the educational status of mothers the proportion of children ever born dead has been found to be very high in illiterate fathers (14.90 per cent) and decreases rapidly with the increase in the educational status of the father.

Family Size and Infant Mortality. Interestingly, the proportion of

children ever born dead has been found to be the highest (24.61 per cent) in small families. This proportion has been found to decrease with the increase in the size of the family.

Economic Status of Family and Infant Mortality. The proportion of children ever born dead has been found to be the lowest (10.18 per cent) in high income families but the highest in the low income families (14 per cent).

Occupation of the Father and Infant Mortality. The proportion of children ever born dead has been found to be the highest in labourers followed by farmers. This proportion has been found to be the least in those families where the father was engaged in other or miscellaneous occupational activities.

Mother's Age at First Birth and Infant Mortality. The proportion of children ever born dead has been found to decrease with the increase in the age of the mother at the time of the first birth except in case of mothers who had their first birth at least at the age of 25 years.

Fertility and Infant Mortality. The proportion of children ever born dead has been found to be positively correlated with the number of pregnancies (r = +0.437). This indicates towards a direct relationship between fertility and infant mortality. On the other hand, it has also been observed that fertility was very high in the families who had experienced more than one infant deaths.

Status of women and infant mortality. In order to analyse the impact of the participation of the woman in the family decision making process on infant mortality, we used a seven point scale to measure the participation in family decision making. The methodology suggested by Guru (1997) was followed for the purpose. The women surveyed were asked about their participation in deciding:

1. The desired number of children the family should have.
2. The care during pregnancy and at the time of delivery.
3. Child rearing and child feeding.
4. The treatment of the sick child.
5. The expenditure in the family.
6. The choice about family food.
7. Working outside the house.

For each variable the degree of participation was categorised as low, moderate and high on the basis of the response given by the women. The low category was given a score of 1; moderate, a score of 2 and high, a score of 3. For each women, scores of all the seven variables were combined. On the basis of this combined score, woman's

participation index was calculated as follows:

Low participation (score 7-11),

Moderate participation (score 12-16), and

High participation (score 17-21).

The participation index was calculated for only 106 Gond women who had completed their fertility at the time of the survey. The analysis suggests that about 20 per cent of the women surveyed had a greater say in the family decision making while about half of the women surveyed enjoyed only a low level of autonomy in the family decision-making. Rest of the women had a moderate level of autonomy in the family. The analysis also suggests that women who enjoyed a high level of participation in the family decision-making experienced relatively low proportion of infant deaths (16.67 per cent). By contrast, the proportion of infant deaths has been found to be the highest (30.56) in women who had little participation in the family decision making. In fact, even moderate level of participation in family decision making has been found to have considerable effect on the proportion of children ever born dead.

Discussion

It is well known that infant mortality is directly related to the level of socio-economic development. At the family level, this implies that the poor is the living status of the family, the higher is the proportion of infant deaths in the family. The analysis carried out in this paper supports this hypothesis. The living condition of the Gond families surveyed may be termed as deplorable, characterised by marked poverty, lack of sanitation, poor housing, etc. A very high proportion of infant deaths in Gond families amply reflects their poor living condition. The analysis suggests that educating Gond women can lead to a substantial reduction in the proportion of infant deaths and improve child bearing as well as health of the entire family. Side by side, the surroundings of a man and his occupation from which he earns his livelihood play an important role in his health habit.

The theory of demographic transition which is based on the experience of today's low birth rate in the developed or industrialized countries holds that the trends in birth rate and family size in a population are determined by the trends of economic production (Misra 1982). It is apparent from the present investigation that the Gond couples are motivated for keeping the level of fertility high order to cope with the high level of infant mortality due to their low levels of

living. It can, therefore, be inferred that to reduce infant mortality, efforts should be made to improve the living status of these families by raising their active participation in economic activities for better employment. At the same time, there also appears to be the need for educating Gond women so that they can participate more actively in the family decision making.

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Table 1
Proportion of infant deaths by different family characteristics

S.N.	Literacy level	No. of mothers	Live births	Infant deaths	
				No.	%
Mother's education					
1	Illiterate	308	1396	208	14.9
2	Primary	52	222	10	4.50
3	Middle and above	10	20	--	–
Father's education					
1	Illiterate	220	980	146	14.90
2	Primary school	64	282	26	9.22
3	Middle school	40	150	10	6.67
4	High school and above	16	56	2	3.57
Family size					
1	Small (up to 3)	76	260	64	24.61
2	Medium (4-6)	216	882	126	14.28
3	Large (7and above)	78	496	28	5.64
Occupation of the Father					
1	Labourer	236	1008	150	14.88
2	Farmer	100	476	54	11.34
3	Govt. Services	16	86	8	9.30
4	Miscellaneous	18	70	6	8.57
Mother's age at first birth					
1	<15 years	12	78	16	20.51
2	15-18 years	200	908	129	14.21
3	19-21 years	134	552	62	11.23
4	22-24 years	20	87	9	10.34
5	25 years and above	4	13	2	15.38

Table 2
Mean number of pregnancies by number of infant deaths

Families with different number of infant deaths	No. of families (n=106)	Mean number of pregnancies per mother
0-1	69	5.26±0.65
2-3	24	7.31±0.74
4 and above	13	10.10±1.63

t-values :
0-1 vs 2-3= 2.09* (d.f.=91)
0-1 vs 4 and above= 2.76* (d.f.=80)
2-3 vs 4 and above= 1.56 (d.f.=35)
* Significant at .05 level of probability

Table 3
Mother's degree of Participation proportion of infant deaths

Level of autonomy	Total births	Infant deaths	
		Number	%
Low	216	66	30.56
Moderate	93	20	21.5
High	42	7	16.67
Total	351	93	

Health Emergencies among Neonates in Andhra Pradesh

Biranchi N. Jena
Anuradha Dubey

Introduction

Five million annual neonatal deaths (98 per cent of the world total) occur in developing countries. Worldwide 37 per cent of under-five deaths are attributed to neo-natal causes. About 75 per cent of under five deaths in India are infant deaths and about half of the under five children die within four weeks of their birth i.e neonatal period (UNICEF 2007). India accounts for 27 per cent of the global burden of neonatal deaths every year (Deorari and Chellani 2007). According to National Family Health Survey-3, the neonatal mortality rate of Andhra Pradesh (40 per 1000 live births) was higher than the national average (39 per 1000 live births) in 2005-06 (IIPS 2007). Neonatal mortality rate in the state varied with the wealth index and level of education of the mother. In the population with lowest wealth index, it was estimated to be around 48 per 1000 thousand live births as against 22.0 per 1000 thousand live births in population with highest wealth index. Education of the mother plays an important role in deciding the level of neonatal mortality as the neonatal mortality rate was highest (46 per 1000 live births) in neonates whose mother had no schooling compared to just 20 per 1000 live births in neonates whose mothers had at least 12 years of schooling (IIPS 2007).

It has been observed in many research studies that prompt recognition and management of complications of the new born can reduce the neonatal mortality rate substantially. The reality, however, is that better access to quality neonatal care remains a major issue in India. The experience of the community-based maternal and neonatal

care programme in Nepal is that even after counselling clients regarding recognition of danger signs and promotion of the message that a woman or newborn should seek care from a qualified service provider immediately if a danger sign is observed, care-seeking for emergencies actually increased only marginally. Such marginal changes are because of many factors including financial, geographic and cultural barriers (USAID 2007). Sometimes service seeking behaviour is constrained because of the non availability of emergency transportation with quality pre hospital care or due to lack of coordination and sharing of responsibility among different service providers. It is therefore important to have a good emergency transportation system to ensure better care seeking behaviour in emergency situation pertaining to neonatal complications.

One of the objectives of the National Population Policy (NPP) 2000 is the reduction in infant mortality rate to less than 30 per 1000 live births by the year 2010. Given the high visibility of neonatal deaths and lack of progress, preventing neonatal death remains a high priority for the government. In view of this, an attempt has been made in this paper to examine and understand the patterns of neonatal deaths in Andhra Pradesh as exhibited by the reported neonatal emergencies through Emergency Management and Research Institute (EMRI).

Objectives

Main objectives of this study are:

- To find out major health emergencies among the neonates and the underlying factors influencing these emergencies.
- To look into trends and patterns of neonatal deaths in Andhra Pradesh.
- To estimate the prevalence of neonatal complications which require emergency care including transport to definite care unit.

Data and Methodology

The study is based on the neonatal emergencies reported to Emergency Management and Research Institute (EMRI) from January 2007 to December 2007. Total number of neonatal emergencies received by EMRI during this period were 563. These emergencies have been studied by using descriptive statistics. Apart from the data from EMRI, information about neonatal mortality rate from sources like SRS, NFHS-3 and WHO Statistics has also been analysed in the context of neonatal complications which require emergency care including transport to an

appropriate health care institution. In Andhra Pradesh, district wise estimates of neonatal deaths are not available. The Directorate of Economics and Statistics, Government of Andhra Pradesh has derived district level estimates of neonatal deaths and neonatal emergencies on the basis of district level estimates of infant mortality rate (Government of Andhra Pradesh 2007). These estimates have been used in the present analysis.

Analysis and Discussion

Five hundred sixty three cases of neonatal emergencies were reported to EMRI in the year 2007. If we look at month wise distribution of reported cases, it appears that cases reported to EMRI had increased significantly from June 2007 onwards. The reason is that EMRI had completed its operations in the whole state of Andhra Pradesh by covering the entire rural segment. This trend in the reporting also indicates towards a huge demand for emergency services pertaining to neonatal complications. Only a small proportion of these cases (7 per cent) were from the urban areas. The NFHS-3 has found that the neonatal mortality rate in the rural areas of Andhra Pradesh is twice that in urban areas. It may be inferred from this observation that the prevalence of neonatal complications is significantly higher in rural than in urban areas. This means that provision of emergency medical care services in the rural areas of the state would result in an accelerated reduction neonatal mortality rate.

Out of total cases report 61 per cent were males and 67 per cent from Scheduled Castes, Scheduled Tribes and other backward classes. It has been observed that the neonatal mortality rate is the highest among Scheduled Castes, followed by Scheduled Tribes and other backward classes.

Neonatal deaths decreased significantly with the increase in the education of the mother. Although education of mother plays a significant role in the neonatal mortality according to NFHS-3, yet reporting of neonatal emergencies and seeking the health care through emergency services has been found to be statistically insignificantly related to female literacy rate. Even the level of awareness about the availability of emergency services was not found to be statistically significantly correlated to the reporting of the neonatal emergencies.

Globally, three major causes of neonatal deaths are: infections (sepsis, pneumonia, diarrhoea, and tetanus (accounting for 36 per cent of neonatal deaths), premature birth (28 per cent) and problems related

to complications during childbirth (23 per cent) (Save the Children Fund). Infections are the major cause of death after the first week of life. In India also, a similar trend may be witnessed with 23 per cent of the neonatal deaths arising due to birth asphyxia, 25 per cent due to preterm births and 36 per cent due to severe infections while the rest due to congenital abnormalities (4 per cent), neonatal tetanus (4 per cent), diarrhoeal diseases (2 per cent) and other neonatal complications (6 per cent) (WHO 2007). In the neonatal emergencies reported to EMRI, the major causes of neonatal emergencies reported were acute respiratory distress syndrome (ARDS)/shortness of breathing (SOB) (60.9 per cent), unconscious (7.5 per cent) tetanus (4.6 per cent) and convulsions (4.6 per cent). The neonatal emergencies reported to EMRI indicate that majority of the emergencies were cases of birth asphyxia. These emergencies and probable neonatal deaths could be avoided if such complications would have been reported as pregnancy related emergencies. Thus, it is important to educate the community to avail emergency services for all pregnancy related complications, as 5-10 per cent of all newborn need resuscitation at birth. Moreover, about 5 per cent deaths were observed out of total emergencies related to ARDS/SOB those were reported to EMRI. Majority of deaths occurred at home before arrival of the ambulance.

If it is assumed that 5-10 per cent of the newborn require resuscitation, then the entire coverage of emergency services for the risk group of 75,000 to 1,50,000 pregnant women would ensure a significant reduction in neonatal mortality rate in Andhra Pradesh because of birth asphyxia. Though currently EMRI is handling 22% of the total pregnancy cases in Andhra Pradesh, it is difficult to estimate the current coverage of the maternal complication cases which pose risk for the neonatal mortality through birth asphyxia. If it is assumed that EMRI handles the same proportion for the risky segment of maternal complication, it is estimated that EMRI handled 16500 to 33000 pregnancy cases in 2007 which required the resuscitation to the new born. Again considering one third of the cases of non-institutional delivery which are of high risk for birth asphyxia, EMRI intervention has ensured proper medical management including resuscitation either through quality pre hospital care and transporting to a suitable health facility.

Apart from birth asphyxia, infections viz. sepsis, pneumonia, diarrhoea etc. contribute significantly to the neonatal mortality. Neonatal sepsis constituted nearly one third of the health problems in

neonates and majority of them are early onset infections (Choudhury et al 2007). This requires specific emergency management and medical management unlike birth asphyxia. The prevention and curative strategy for neonatal infections require clean childbirth, cord care, hygienic baby care, skilled birth attendant, early identification of complication and medical management through antibiotics. An effective emergency management system would ensure the fulfilment of such conditions to a great extent.

District wise neonatal deaths in Andhra Pradesh had been estimated on the basis of district level infant mortality rate (IMR) and the state level neonatal mortality rate by the following formula

$$NMR_i = IMR_i * (NMR_{AP} / IMR_{AP}),$$

where NMR_i = Neonatal mortality rate in i^{th} district

IMR_i = Infant mortality rate in i^{th} district

NMR_{AP} = Neonatal mortality rate in whole Andhra Pradesh

IMR_{AP} = Infant mortality rate in whole Andhra Pradesh

The exercise indicates that neonatal mortality rate was high in Mahabubnagar (51 per 1000 live births), Medak (46 per 1000 live births) and Adilabad (45 per 1000 live births) districts but low in Hyderabad (18) and West Godavari (25) districts.

The estimated neonatal death Rate out of the all emergencies reported to EMRI was calculated by dividing the total deaths up to 48 hours of reporting of the emergency and served by EMRI by total number of cases reported to EMRI. This death rate has been estimated to be around 78 deaths per 1000 emergencies being reported. If the urban and rural difference is taken into consideration, it is found that the neonatal death rate in rural areas was 66 per 1000 neonatal emergencies reported, where as this rate was as high as 234 per 1000 emergencies reported from urban areas. Such a difference may be due to the wide variations in the onset of neonatal complications and reporting of such cases to EMRI. However this difference in the neonatal death rate in rural and urban areas requires further investigation.

Based on the neonatal mortality rate of 40.3 deaths per 1000 live births (IIPS 2007) and death rate of 78 per 1000 reported emergencies, it may be inferred that 51 per cent of the live births in Andhra Pradesh require emergency care services including emergency transport to the appropriate health facility. The causes of the neonatal mortality suggest that 48 per cent of neonatal deaths were due to pre-term births and birth asphyxia which could have effectively been managed by ensuring cent

per cent safe deliveries. It is important to note that 52 per cent of the neonatal deaths are due to infections which could effectively be managed through a good emergency response service system like EMRI.

The paper also estimated total number of emergencies that would occur after controlling causes like pre-term delivery and birth asphyxia. The estimation was done in the following way

$$NEOEMIi = [NDi*(NMR_l/NMR_e)]*[1-0.48]$$

Where $NEOEMIi$ = Estimated Neonatal Emergencies because of Infections in i^{th} district

NDi = Total neonatal Deaths in i^{th} district

NMR_l = Neonatal Mortality Rate per 1000 live births

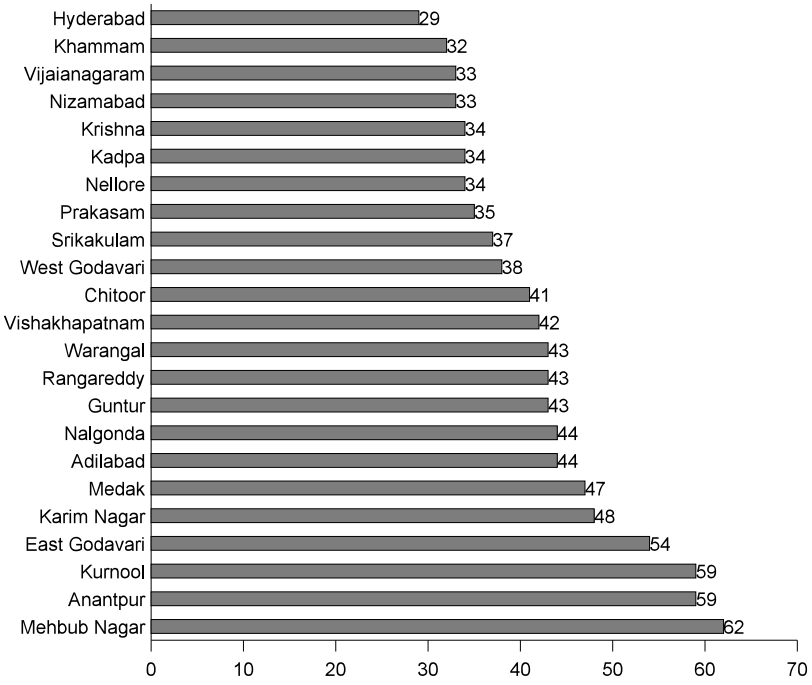
NMR_e = Neonatal Mortality Rate per 1000 neonatal emergencies reported

Results of the exercise indicate that there were 1092 neonatal emergencies which are occurring every day across Andhra Pradesh because of infections only. In other words, the prevalence rate of neonatal emergencies because of infections was 260 per 1000 live births.

District level estimates of neonatal emergencies per day which require hospitalisation are shown in figure 1. The figure shows that per day neonatal emergencies was high in Mehbub Nagar (62), Anantapur (59), Kurnool (59) and East Godavari (54) districts as compared to Nizamabad (33), Vizianagaram (33), Khammam (32) and Hyderabad (29) districts. It was found that districts having high neonatal mortality report high neonatal emergencies and vice versa.

It is obvious from the foregoing discussions that an early identification of complications and good pre hospital care would reduce the neonatal mortality rate to a significant extent. If neonates requiring care are identified and referred to appropriate facility at appropriate time, they can be effectively treated and it will be possible to achieve substantial decline in the neonatal mortality rate (Government of India *no date*). The effectiveness of facilitating access to the appropriate health facility largely depends on the availability of quick and effective transport system. Distance from health outlets and logistic difficulties such as finding an intermediate or motorised vehicle for patient transfer are linked with inhibited use of biomedical services (Ensor and Cooper 2004, Hodgkin 1996, Raghupathy 1996) and delayed health-seeking behaviour both of which are factors implicated in reduced health outcomes and increased morbidity and mortality in studies from Vietnam (Ensor 2004) and Zimbabwe (Fawcus et al 1996).

Figure 1
Estimated daily prevalence of neonatal emergencies in districts of Andhra Pradesh, 2007



Neonates with a long duration of transport had 79 per cent higher odds of death than those transported for a short duration after adjusting the confounding effects. The study found that neonatal health emergencies which took more than 90 minutes of transport had more than two times higher risk of death than those who were transported in less than 60 minutes while the risk was 80 per cent more in those transported between 60 and 89 minutes. A study in Himachal Pradesh estimated that government hospital was accessible at the travel distance of less than an hour in 20 per cent cases, 1-2 hours in 49 per cent cases and more than 2 hours in 19 per cent cases and transport were in the form of bus or other motorised transport facility (Rintaro Mori et al 2006). The EMRI takes, on average, less than 45 minutes to transport a neonatal emergency to a hospital to the hospital with pre-hospital care in 40 per cent of cases, between 45-60 minutes in 28 per cent of the cases and more than 60 minutes in rest of the 32 per cent cases. Obviously,

EMRI contributes to a significant decline in the risk of death in neonates who require emergency health care.

Conclusions

Although, neonatal mortality rate in Andhra Pradesh is 40 per 1000 live births, yet reported neonatal emergencies are very low and are not significantly correlated to awareness level of emergency services. There exists a huge demand of neonatal emergency services in the rural areas.

The findings of our analysis suggest two critical areas to reduce neonatal mortality rate. First, one of the major causes of neonatal emergency - birth asphyxia - can be avoided if such cases were reported as pregnancy related complications. There is a need to educate the community to avail the emergency services for all pregnancy related complications. Second, more than 1000 neonatal emergencies are estimated to occur every day across Andhra Pradesh due to infections which can be prevented and cured by early identification of complications and good pre hospital care. Facilitating quick and effective transport system is critical in this regard. EMRI ensures an effective pre hospital care with quick and free transport facility.

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Table 1
Estimated neonatal deaths in districts of Andhra Pradesh

District	Live births	Infant deaths	Estimated		Reported cases	
			NMR	Neonatal Deaths	Total	Per cent to neonatal deaths
Adilabad	54896	3508	50.8	2788	22	0.79
Anantapur	77942	4700	47.9	3736	28	0.75
Chittoor	70149	3255	36.9	2587	20	0.77
East Godavari	93736	4265	36.2	3390	33	0.97
Guntur	81451	3429	33.5	2726	42	1.54
Hyderabad	87427	2308	21	1835	16	0.87
Kadapa	53498	2712	40.3	2156	41	1.9
Karim Nagar	75298	3780	39.9	3005	10	0.33
Khammam	42413	2549	47.8	2026	13	0.64
Krishna	81763	2674	26	2125	11	0.52
Kurnool	79317	4624	46.3	3676	37	1.01
Mahabub Nagar	67759	4879	57.2	3878	34	0.88
Medak	56681	3690	51.7	2933	16	0.55
Nalgonda	55586	3496	50	2779	24	0.86
Nellore	57014	2725	38	2166	15	0.69
Nizamabad	41271	2608	50.8	2096	18	0.86
Prakasam	55942	2797	39.7	2223	29	1.3
Rangareddy	77748	3429	35.1	2725	20	0.73
Srikakulam	46860	2901	49.2	2306	29	1.26
Vishakapatnam	63725	3339	41.7	2654	28	1.05
Vizianagaram	43691	2608	47.5	2073	14	0.68
Warangal	66068	3429	41.3	2726	27	0.99
West Godavari	82744	3004	28.9	2387	36	1.51
Total	1512979	76709	32	60997	563	0.92

Table 2
Neonatal mortality rate and cases requiring hospitalisation

District	IMR	Estimated			Per day hospitalised
		NMR	Total neonatal deaths	Emergencies requiring hospitalisation	
Adilabad	64	45	2480	31172	85
Anantapur	60	43	3323	41764	114
Chittoor	46	33	2301	28924	79
East Godavari	46	32	3015	37898	104
Guntur	42	30	2424	30470	83
Hyderabad	26	19	1632	20509	56
Kadapa	51	36	1917	24099	66
Karim Nagar	50	35	2673	33589	92
Khammam	60	42	1802	22650	62
Krishna	33	23	1891	23761	65
Kurnool	58	41	3269	41089	113
Mahabub Nagar	72	51	3450	43354	119
Medak	65	46	2609	32789	90
Nalgonda	63	44	2472	31065	85
Nellore	48	34	1927	24214	66
Nizamabad	63	45	1844	23174	63
Prakasam	50	35	1978	24854	68
Rangareddy	44	31	2424	30470	83
Srikakulam	62	44	2051	25778	71
Vishakapatnam	52	37	2361	29670	81
Vizianagaram	60	42	1844	23174	63
Warangal	52	37	2424	30470	83
West Godavari	36	26	2124	26693	73
Total	57	40	60973	766320	2100

Table 3
Requirements of neonatal emergency services

District	Neonatal deaths which can be managed	Emergencies requiring hospitalisation	Per day Emergencies
Adilabad	1290	16209	44
Anantapur	1728	21717	59
Chittoor	1197	15040	41
East Godavari	1568	19707	54
Guntur	1261	15844	43
Hyderabad	849	10665	29
Kadapa	997	12531	34
Karim Nagar	1390	17466	48
Khammam	937	11778	32
Krishna	983	12356	34
Kurnool	1700	21366	59
Mahabub Nagar	1794	22544	62
Medak	1357	17050	47
Nalgonda	1285	16154	44
Nellore	1002	12591	34
Nizamabad	959	12051	33
Prakasam	1028	12924	35
Rangareddy	1261	15844	43
Srikakulam	1067	13405	37
Vishakapatnam	1228	15428	42
Vizianagaram	959	12051	33
Warangal	1261	15844	43
West Godavari	1104	13881	38
Total	31706	398487	1092

Clinical Study of Trauma in Children

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Manish Kumar

Introduction

Trauma is leading cause of morbidity and mortality in paediatric patients. Paediatric trauma is one of the major threats to the health and well being of children. Factors influencing childhood injuries include age, sex, behaviour of child and parents, cause of injury and environment. Of these, age, sex and cause are the most important factors affecting patterns of injuries.

Males below 15 years have higher injury and mortality rates than females probably because of their more aggressive behaviour and exposure to contact sports. Tragically, home environment is the next most common scene of paediatric injury. About 36 per cent of injuries occur in very environment that should be sheltering and nurturing children. In India, children less than 15 years of age comprise about 40 per cent of the total population; they constitute a high risk group as far as trauma is concerned. It has been reported that 50 per cent of all deaths occurring in developing countries like India is contributed by 0-14 years age group.

The morbidity and mortality in paediatric and adolescent age groups are also indicators of the health of the population like the infant mortality rate. It is, therefore, important that preventive and rehabilitation measures are taken at different tiers of health care in the management of trauma and other diseases in paediatric patients.

The present paper reports the findings of a study about the socio-epidemiology of trauma in paediatric patients aged 0-14 years who were admitted in surgical wards of Sanjay Gandhi Memorial Hospital,

Rewa, Madhya Pradesh during the period August 2006 through July 2007. Patients were admitted to surgical wards from either the Out Patient Department or casualty or they were transferred from other wards. On admission, a detailed history including time, date, place, cause, mode of injury and whether first aid was received or not were obtained from either the patient or from the person accompanying the patient. In addition, information about the age, sex, religion, date and time of admission, date of discharge/referral/death were also collected in addition to eliciting the history of symptoms specific to any organ system injured. Based on this information, a provisional diagnosis was made and resuscitation was started. An intra-veins access was secured and appropriate antibiotics and analgesics were administered. Subsequently, a thorough assessment of the general condition of the child and the status of injuries was carried out and appropriate management was instituted. Every attempt was made to stabilise the vitals of the child – airway, breathing and circulation.

The study focussed on the following aspects of socio-epidemiology of trauma in children:

- To find out the incidence of traumatic lesions in the paediatric age group.
- To find out age and sex distribution of various traumatic lesions in paediatric patients.
- To find out the most common causes of trauma in paediatric patients.
- To find out the morbidity and mortality in paediatric patients with traumatic lesions.

Review of Literature

A World Health Organisation advisory group in 1956 defined accident as an "unpremeditated event resulting in a recognisable damage" (WHO 1957). Traumatic lesions are main causes of morbidity and mortality in childhood and adolescence accounting for 37-68 per cent deaths in boys and 25-43 per cent deaths in girls.

Sharma and others (1981) found a gradually increasing trend with age in the incidence of trauma in children. The prevalence of trauma was found to be 7.5 per cent in the age group 0-4 years which increased to 15.9 per cent in children 5-14 years of age. Across the entire paediatric age group, trauma constituted about 22.5 per cent of the reported morbidity. Most common causes of trauma in children were fall, vehicle accidents and burns in that order.

Traumatic injuries continue to be the leading cause of death in children (Bamaniya 2005, Theissen and Woolridge 2006). Major causes of childhood morbidity and mortality are:

1) *Head Injury*. It is one of the most common causes paediatric trauma for attending emergency and account for half of the patients below 15 years of age. It includes fractures, intra cranial haemorrhages, contusions, lacerations, etc. Among children, CNS is the most commonly injured isolated system. Because CNS is the leading cause of death among injured children, it is the principal determinant of the outcome. However, numerous observations have shown that children recover more frequently and fully than similarly injured adults. In children younger than 2 years, physical abuse is the most common cause of serious head injury whereas, in children aged 3 years and older, fall and road accidents are responsible for most traumatic brain injuries.

2) *Thoracic Injury*. It is the second leading cause of death in paediatric trauma. The chest wall is very *compliant* in children. Therefore, significant intra-thoracic injuries can occur without fracture of ribs or significant external injuries. Aspiration of gastric contents is very common following paediatric trauma and the resultant pneumonitis contributes markedly to any chest injury.

3) *Abdomino-pelvic Injuries*. Following the head and extremities, the abdomen is the third most commonly injured anatomical region in children. It can be associated with significant morbidity and may have mortality rate as high as 8.5 per cent. Children with abdominal trauma secondary to assault or abuse have the highest mortality rate out of all causes of abdominal trauma.

4) *Burns*. Burns are the third leading cause of mortality in patients younger than 5 years. Overall morbidity from thermal injury has decreased markedly in the recent years, with an aggressive multidisciplinary approach of the care. Approximately 90 per cent of the burn injuries are caused by household accidents or child abuse. In children below 3 years of age, scalds are responsible for most of the burns while in children aged at least 3 years, flame burns have been found to be more common.

5) *Child Abuse*. It includes physical abuse, sexual abuse, emotional abuse and child neglect. Child abuse involves children of all ages crossing all socioeconomic boundaries, although poverty, a young single parent, and substance abuse, are the major risk factors. Most of the abused children are younger than 3 years with one third being

younger than 6 months. One of the unique varieties of paediatric trauma is battered baby syndrome.

Advanced trauma and life support system (ATLS)

The advanced trauma and life support system, essentially, comprises of four steps:

Step 1 Consists of focused primary survey aimed at rapidly assessing the airway, breathing, and circulation (ABCs). In addition, abbreviated neurological assessment (D) and completely exposing (E) the child to thoroughly search for injuries is also done.

Step 2 Consists of resuscitation in which an intra-veins line is secured and appropriate crystalloids or colloids or blood is given.

Step 3 Consists of a secondary survey, which consist of a head to toe physical examination to identify all traumatic injuries.

Step 4: consist of definitive management of the patient.

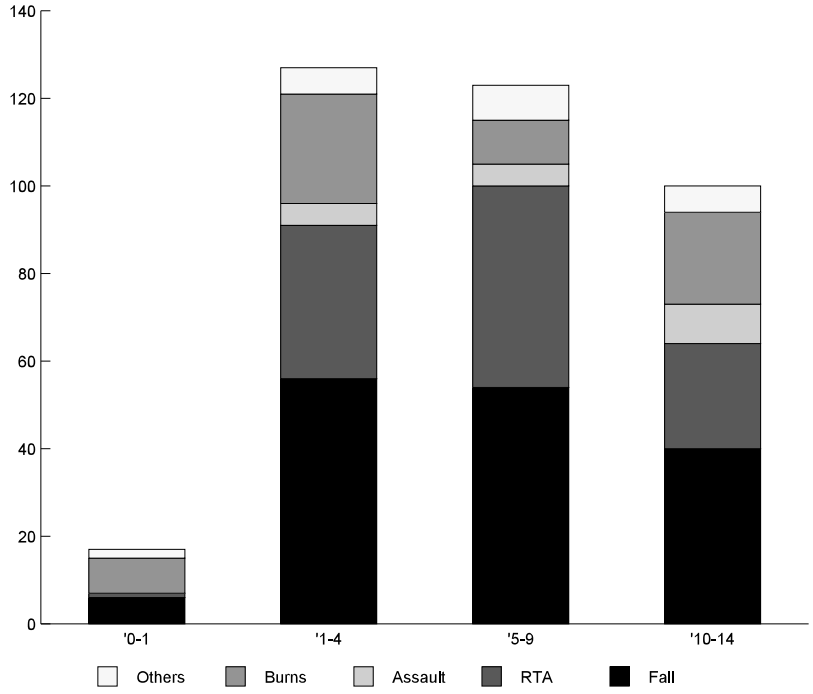
Observations

During the period under reference, a total of 6073 patients were admitted in the surgical wards of the Sanjay Gandhi Memorial Hospital Rewa. Out of these 6073 patients, 993 or about 16.35 per cent patients were paediatric patients - patients below 15 years of age and 367 paediatric patients were related to paediatric trauma. This amounts to almost 37 per cent of the paediatric patients and about 6 per cent of the total patients admitted in the surgical wards of the hospital.

The age wise distribution of the paediatric patients with trauma admitted to the hospital suggests that maximum paediatric trauma patients were in the age group 1-4 years closely followed by patients in the age group 5-9 years. There appears to be a substantial decrease in the incidence of paediatric trauma in the age group 10-14 years. The most common cause of paediatric trauma is the fall from a height which was found to be the reason behind trauma in about 42 per cent of the paediatric trauma patients admitted in the hospital followed by road traffic accidents (RTA). Fall and RTA accounted for more than 70 per cent of the paediatric trauma patients. On the other hand, during infancy, burn injuries appear to be a major cause of trauma.

Nearly two-third of the paediatric trauma patients admitted in the hospital were male while only around 33 per cent were females. It appears that male children are more prone to trauma (63 per cent) as

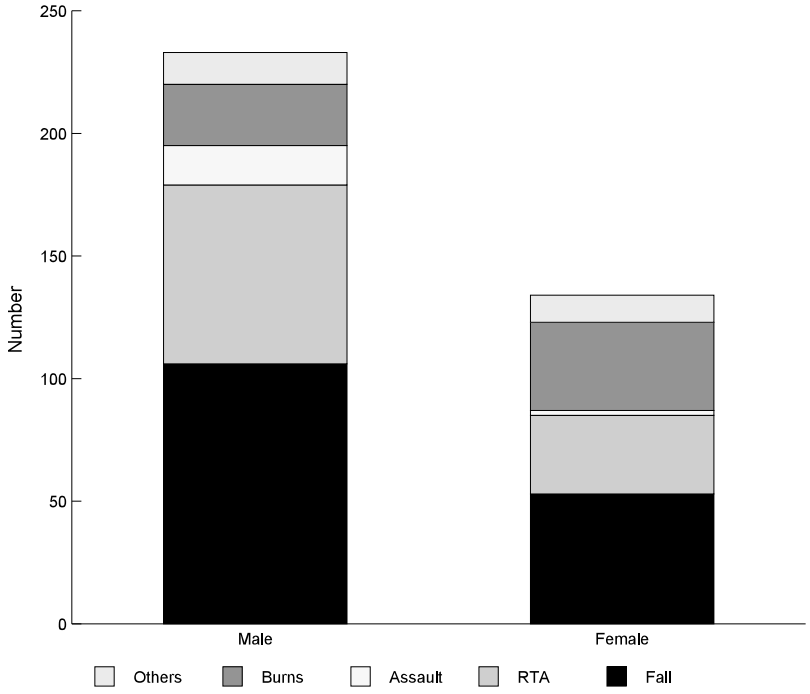
Figure 1
Distribution of paediatric trauma cases by age and type of trauma



compared to their female counterpart (36 per cent), although use of hospital services has often been found to be sex selective, especially in case of children. Female children appear to have a higher risk of sustaining burn injuries (59 per cent) as compared to male children (41 per cent). By contrast, male children appear to have higher risk of trauma from fall, assault and RTA.

The overall fatality among paediatric patients with trauma admitted in the hospital was approximately 14 per cent. Fatality was the highest in infants - children below one year of age (70.6 per cent) followed by children aged 10-15 years (17 per cent). Interestingly, fatality from trauma was comparatively low in the age group 1-10 years. Fatality increased with the increase in the time between sustaining trauma and admission in the hospital. The prevalence was the least in children aged 1-10 years. In paediatric patients admitted in the hospital within 6 hours of sustaining trauma, the fatality rate was estimated to be around 13 per

Figure 2
Distribution of trauma cases by sex and type of trauma



cent which increased to around 16 per cent in paediatric trauma patients who were admitted in the hospital after sustaining trauma more than 6 hours ago. Moreover, fatality was found to be higher in female paediatric patients as compared to female paediatric patients.

Conclusions

This study has shown that, even though the incidence of paediatric trauma has remained stable in this part of India, there has been an increase in the number of RTA and injuries due to mechanical and electrical gadgets. Due to better transport facilities more number of children now receives definitive treatment early. This however has not translated into a significant decrease in morbidity and mortality rates. This is because management of paediatric trauma is a specialised job and requires a paediatric surgeon and a paediatric anesthetic among others. Establishment of Paediatric Trauma Care Centres at all nodal or

tertiary centre is a must for proper treatment of paediatric trauma victims.

Trauma in children dramatically affects the economy because of the expenses for medical care, rehabilitation and costs related to the inability of children to function independently in society. Therefore, injury prevention should be the priority for everyone.

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Table 1
Age distribution of causes of paediatric injury

Age Group	Fall	RTA	Assault	Burns	Others	Total
0-1	6	1	0	8	2	17
1-5	56	35	5	25	6	127
5-10	54	46	5	10	8	123
10-15	40	24	9	21	6	100

Table 2
Sex wise distribution of paediatric trauma patients

Cause of Injury	Male	Female
Fall	106	53
RTA	73	32
Assault	16	2
Burns	25	36
Others	13	11
Total	233 (63.48%)	134 (36.52%)

Table 3
Mortality rates in different age groups

Age group (Years)	Total patients	Total deaths	Proportion of deaths (Per cent)
0-1	17	12	70.60
1-5	127	14	11.02
5-10	123	8	6.50
10-15	100	17	17.00
Total	367	51	13.89

Nutritional Status of Women in Madhya Pradesh

Nalin Singh Negi
Adil Hussain Khan

Introduction

In this paper, we analyse the nutritional status of women in Madhya Pradesh as measured through anaemia and body mass index (BMI). There exists a two way relationship between the nutritional status of women and their health status. The poor health status of women resulting from a host of social, cultural, economic, environmental and services delivery factors aggravates the problem of under nutrition as reflected through high prevalence of anaemia and low body mass index in women. In turn, poor nutritional status of women contributes to poor health status of women as reflected through high morbidity and mortality. Adequate nutrition influences women's ability to cope with diseases and rigours of everyday life.

Both nutrition and health status of women are intrinsically linked to their status in the society. Research on women's status has found that contributions women make to families are often overlooked and, instead, they are viewed as economic burdens. There is a strong son preference in the society, as sons are expected to care for parents as they age. This son preference, along with high dowry costs for daughters, sometimes results in the mistreatment of daughters. Further, women have low levels of education and formal labour force participation. This situation typically leads to little autonomy for women. They first live under the control of first their father, then their husband, and finally their sons (Chatterjee 1990, Desai 1994, Horowitz and Kishwar 1985). All these factors exert a negative impact on the level of health and

nutrition of women. There are several studies that conclude that one of the reasons for the poor health and nutritional status of Indian women is the discriminatory treatment girls and women receive compared to boys and men in the family and the society (Das Gupta 1994, Desai 1994). Anaemia in women is a serious concern as it can result in abortions, low birth weight babies, poor immune system, pregnancy complications and make women vulnerable towards various diseases. According to NFHS-3 (2005-06) less than 45 per cent pregnant women in the state received ante-natal care, 36 per cent had institutional deliveries while around 61 per cent children below 3 years and 47.6 per cent ever married women suffered from anaemia. Anaemia is a major outcome of malnutrition among women in Madhya Pradesh.

Methods and Materials

The analysis presented here is based on the information available through the National Family Health Survey 2005-06 which covered 6427 women across Madhya Pradesh. The paper uses body mass index (BMI) and anaemia as key indicators of women's nutritional health. The body mass index (BMI) is a widely used indicator of nutritional status. It is defined as the weight in kilograms divided by the height in metres squared (kg/m^2). According to WHO, a cut-off point of 18.5 is used to define thinness or acute underweight and a BMI of 25 or above indicates overweight or obesity. A BMI ranging between 18.5 to 24.9 refers to normal weight. The sample for analysis of BMI excludes women who were pregnant at the time of the survey and women who gave birth during the two months preceding the survey, as estimation of anthropometric indices for measuring BMI will be over estimated. Therefore for BMI analysis is based on 5906 women.

Anaemia in women, on the other hand, is calculated by dividing weight of haemoglobin by per decilitre of blood. According to WHO, anaemic women are identified and appropriate adjustments were made for respondents living at altitudes above 1000 metres and respondents who smoke, since both of these groups require more haemoglobin in their blood. Three levels of anaemia are distinguished: mild anaemia (10-10.9 grams/decilitre for pregnant women, 10.0-11.9 g/dl for non pregnant women), moderate anaemia (7.0-9.9 g/dl) and severe anaemia (less than 7.0 g/dl). However, for further analysis, women surveyed were classified into categories - anaemic and non-anaemic. Irrespective of BMI, for assessing anaemia in women, all the women were included in the analysis.

In order to assess the effect of a number of social, economic and demographic factors on anaemia, logistic regression has been applied. The dependent variable used in the analysis was whether the women surveyed were anaemic or not. If the woman was anaemic at the time of the survey, a value of 0 was given. If the woman was not anaemic, a value of 1 was given. On the other hand, BMI has three categories - underweight, normal and overweight. As such instead of logistic regression, multinomial regression analysis has been carried out.

Predictors of Anaemia and BMI. A number of variables are considered to represent dimensions of socio-economic and demographic characteristics of women. Taking into account theoretical considerations as well as results from a series of exploratory models, independent variables considered in the analysis included: women's present age (15-24/24-34/35-49), total children ever born (0/1-2/3 and above), caste (general/SC or ST/ OBC), religion (Hindu/non-Hindu), residential status (rural/urban), education of woman (no education/primary/secondary/higher), marital status (currently married/never or ever married), standard of living index (low/medium/high), occupation of woman (not working/non agriculture/agriculture), mass media exposure (no/yes), decision on health (alone/others), fuel used for cooking (smokeless fuel/smoke producing fuel), and violence faced (yes/no).

Findings and discussions

Background Characteristics of Women in Madhya Pradesh. Table 1 gives details about basic characteristics of women included in the analysis. About 28 per cent of women did not have any child whereas about 29 per cent had 1-2 children. About one third of the women belonged to either Scheduled Castes or Scheduled Tribes. Most of the women surveyed were Hindus; 48 per cent belonged to rural areas and 40 per cent were illiterate while 77 per cent were currently married. Half of the women surveyed belonged to families with high standards of living while 53 per cent were not working anywhere whereas 22 per cent women are working in agricultural sector. Three fourth of the women had exposure to mass media. However, three fourth women reported that they did not take decisions regarding their health at their own. More than half of the women reported that they used fuel which produced smoke which was harmful for their health. Domestic violence was not found to be a serious problem in the surveyed women as 75 per cent of them reported that did not face any kind of violence.

Prevalence of Anaemia and BMI . Overall 55 per cent women aged 15-49 years surveyed were found to be anaemic (Table 2). The prevalence of anaemia was found to be the highest in the age group 35-49 years and in women having at least 2 children. The prevalence of anaemia has also been found to be comparatively high in Scheduled Castes, Scheduled Tribes and other backward class women as compared to women from upper castes. Similarly, prevalence of anaemia has been found to be higher in Hindu women compared to women of other religions and in women from rural areas as compared to their urban counterparts. The prevalence of anaemia has been found to be inversely related to the level of education and the standard of living index while non-working women were found to be less anaemic than working women and woman working in the agricultural sector. Factors like marital status, exposure to mass media and autonomy in decision making were found to have little impact on the prevalence of anaemia. Finally, prevalence of anaemia was found to be significantly higher among women with BMI <18.5 (kg/m^2) as compared to women with BMI>18.5 (kg/m^2).

The BMI among the women surveyed suggests that chronic energy deficiency was more in younger women (less than 25 years of age) than in older women. Similarly, chronic energy deficiency was more in Scheduled Castes and Scheduled Tribes women than in women belonging to other backward classes and upper castes. In the rural areas of the state, about 37 per cent women were having a BMI<18.5 compared to only 28 per cent in the urban areas which suggests that chronic energy deficiency is higher in the rural areas. Like anaemia, BMI has also been found to vary inversely with the level of education and standard of living. Women having exposure to mass media had a higher BMI as compared to women not exposed to mass media. On the other hand, work status of women and the fuel used for cooking had an impact on BMI.

Factors Determining Nutrition Status of Women. Logistic regression was applied to explore statistically significant determinants of anaemia in women whereas multinomial regression analysis was carried out to find out the determinants of BMI in the surveyed women. The regression coefficients were converted into percentages in the multiple classification analysis. The results are given in table 3. For this purpose anaemia has been categorized as 0 (not anaemic) and 1 (anaemic). Significant factors of anaemia in women have been found to be the age, caste, place of residence, exposure to mass media, children ever born and BMI. Women in the age group 25-34 are 21 per cent more likely to

be anaemic compared to women aged 15-24 years. Women having 1-2 children were found to be 24 per cent less likely to have anaemia compared to women with zero parity. On the other hand, Scheduled Castes/Tribes women were found to be 37 per cent more likely to be anaemic compared to women from upper castes. Women who did not have exposure to mass media were 1.2 times more likely to be anaemic as compared to exposed to mass media exposure. The odds of being anaemic were found to be higher in women working in the agricultural as compared to non-working women. Women who used fuel which did not produce smoke were 2 per cent less likely to be anaemic.

Across different age group, there are similar proportion of women with low BMI but 18 per cent women in the age group 35-49 were obese. About 34 per cent SC/ST women were having a low BMI whereas this proportion for general women was only 27 per cent. Women of other religions are more underweight and obese than Hindu women. Women with low BMI are found to be more in rural area and obese women are found to be in urban areas. As education and SLI is increasing women are found to be more obese. Women working in agricultural sector are thinner than non working women and working in non-agricultural sector. Decision on their own about their own health and violence has no impact on BMI.

Conclusions

Drudgery and workload is associated with women from their very childhood. Apart from the routine work, women hardly get any time for personal development. As both anaemia and BMI reflect the nutritional status of women therefore it can be said that nutritional status is poor among women of Madhya Pradesh. The substantial variation in the nutritional status of women in Madhya Pradesh appears to be due to differences in age, caste, mass media exposure and children ever born. There is a need to appraise rural women, especially those with many children about the importance of health. The social, economic and cultural dimensions embedded within the Indian social system may in turn govern the health-seeking behaviour.

The present analysis reveals that the health and nutritional status of women in Madhya Pradesh is largely shaped by socio-economic and demographic factors, either at the individual or at the household level. Health and nutrition interventions should therefore be made according to the culture of the population. Educated women are better placed to break away from the tradition to utilise modern means of safeguarding

their own health and health of their children and are better able to utilise what is available in the community. As health programmes are the source of strength to all other schemes of social and economic development, effective measures need to be initiated to improve health performance in Madhya Pradesh. There is a need of formulating policies and programmes on the basis of realistic estimates and parameters and more meaningfully in a decentralised manner. Identification of regions and broad cultural groups within each region on the basis of their performance in health programme should be initiated.

In conclusion, it is observed that the number and types of variables and their extent of influence on health across different cultural and regional groups vary significantly. In spite of so many years of planned development for the upliftment of women, the status of women in Madhya Pradesh has not changed significantly. Issues related to women's health and nutrition, particularly in the backward states like Madhya Pradesh where access to basic health facilities is still poor need to be addressed. Partnership with communities and non-government organisations as well as committed private enterprises could be fruitfully engaged but public expenditure would continue to play a leading role. The challenge before policy makers is to develop institutions that can offer cost effective solutions to problems of access and availability of health and nutrition facilities.

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Table 1
Percentage distribution of women according to different background characteristics. Madhya Pradesh, 2005-2006

Background characteristics	%	Background characteristics	%
Age of Women		*Standard of Living*	
15-24	36.1	Low	21.9
25-34	30.9	Medium	27.3
35-49	32.9	High	50.3
Total Children Ever Born		*Occupation*	
0	27.4	Not working	52.7
1-2	29.1	Non-agriculture	24.9
3 and above	43.5	Agriculture	22.4
Caste		*Mass Media Exposure*	
General	28.3	No	24.6
SC/ST	33.6	Yes	75.4
OBC	38.1	*Decision on health*	
Religion		Respondent alone	24.4
Hindu	87.6	Others	75.6
Non-Hindu	12.4	*Fuel used for cooking*	
Place of Residence		Smoke less fuel	44.6
Rural	47.5	Smoke producing fuel	55.4
Urban	52.5	*Violence*	
Education		No violence	75
No education	39.5	Faced violence	25
Primary	15.5	*Body Mass Index*	
Secondary	34	<18.5	34.5
Higher	11	18.5-24.9	57.3
Current Marital Status		>25	8.2
Currently married	76	*Anaemia*	
Not currently married	23.4	Anaemic	51.1
		Not anaemic	48.9

Table 2
Percentages of anaemic women and BMI according to various background characteristics. Madhya Pradesh, 2005-2006.

Background Characteristics	Per cent Anaemic (N=6427)	Body Mass Index (N=4268)		
		<18.5	18.5-24.9	>25
Age of Women				
15-24	55.4	37.9	58.9	3.3
25-34	55.3	34.3	59.4	6.3
35-49	57.2	30.9	53.9	15.2
Total Children Ever Born				
0	49.8	37.4	58.4	4.2
1-2	57.5	32.6	56.6	10.8
3 and above	58.5	33.8	57.1	9.1
Caste				
General	46.3	23.2	58.1	18.7
SC/ST	66.2	39.1	56.8	4.1
OBC	51.1	36.1	57.4	6.5
Religion				
Hindu	57.2	34.9	58.1	7.0
Non-Hindu	44.6	30.8	49.8	19.4
Place of Residence				
Rural	59.6	37.0	59.5	3.5
Urban	46.9	28.1	51.8	20.1
Education				
No education	61.0	37.1	58.0	4.9
Primary	56.7	35.9	55.8	8.4
Secondary	49.9	32.0	57.5	10.5
Higher	37.8	18.7	55.5	25.8
Current Marital Status				
Currently married	57.9	33.2	57.5	9.3
Never/formerly married	49.0	38.6	56.8	4.6
Standard of Living				
Low	61.8	40.8	56.8	2.5
Medium	59.1	38.5	57.6	3.8
High	47.9	24.8	57.6	17.6

Background Characteristics	Per cent Anaemic (N=6427)	Body Mass Index (N=4268)		
		<18.5	18.5-24.9	>25
Occupation				
Not working	51.9	31.4	55.7	12.9
Non-agriculture	57.2	35.5	57.5	7.0
Agriculture	60.8	37.9	59.4	2.7
Mass Media Exposure				
No	62.8	39.2	57.9	2.9
Yes	52.1	31.8	57.0	11.2
Decision on health				
Respondent alone	57.6	29.7	57.1	13.2
Others	58.0	34.1	57.6	8.2
Fuel used for cooking				
Smokeless	46.0	22.3	54.0	23.7
Smoke producing	58.5	37.6	58.2	4.2
Violence				
No violence	54.2	34.4	56.4	9.2
Faced violence	60.6	34.7	59.7	5.6
Body Mass Index				
<18.5	59.5	-	-	-
18.5-24.9	56.2	-	-	-
>25	39.4	-	-	-
Total	*56.0*	*34.5*	*57.3*	*8.2*

Table 3
Factors determining prevalence of anaemia among women, Madhya Pradesh, NFHS-3 (2005-2006)

Background characteristics	Odds Ratio	Background characteristics	Odds Ratio
Age of Women		*Standard of Living*	
15-24 ®	1	Low ®	1
25-34 **	1.21	Medium	1.02
35-49	1.05	High	1.16
Total Children Ever Born		*Occupation*	
0 ®	1	Not working ®	1
1-2 **	0.76	Non-agriculture	1.14
3 and above	0.83	Agriculture	1.07
Caste		*Mass Media Exposure*	
General ®	1	No ®	1
SC/ST *	1.37	Yes *	1.24
OBC *	1.13	*Decision on health*	
Religion		Respondent alone ®	1
Hindu ®	1	Others	0.93
Non-Hindu	0.99	*Fuel used for cooking*	
Place of Residence		Smoke less fuel ®	1
Rural ®	1	Smoke producing fuel	1.02
Urban ***	1.22	*Violence*	
Education		No violence ®	1
No education ®	1	Faced violence	0.94
Primary	0.87	*Body Mass Index*	
Secondary	1.05	<18.5 (CED) ®	1
Higher	1.27	18.5-24.9 (Normal)*	1.24
Current Marital Status		>25 (Overweight)*	1.75
Currently married ®	1		
Not currently married	1.22		

***p<0.01 **p<0.05 *p<0.10; ®= Reference category

Table 4
Multinomial logistic regression of BMI according to various background characteristics. Madhya Pradesh, NFHS 2005-2006

Background Characteristics	Energy deficiency	Normal	Overweight
Age of Women			
15-24	33.5	63.1	3.4
25-34	31.9	61.9	6.2
35-49	27.4	53.9	18.8
Total Children Ever Born			
0	29.7	61.9	8.4
1-2	33.9	59.0	7.2
3 and above	31.3	61.3	7.4
Caste			
General	27.4	63.5	9.1
SC/ST	34.1	58.6	7.2
Other Backward Caste	32.5	60.5	6.9
Religion			
Hindu	31.0	61.8	7.2
Non-Hindu	35.5	53.6	10.9
Place of Residence			
Rural	33.0	62.0	5.0
Urban	30.0	59.1	10.9
Education			
No education	32.4	61.3	6.4
Primary	33.5	58.5	8.0
Secondary	29.5	61.6	8.8
Higher	31.5	58.8	9.6
Standard of Living			
Low	39.4	56.1	4.5
Medium	36.4	59.2	4.5
High	25.9	62.0	12.1
Occupation			
Not working	30.8	59.4	9.8
Non-agriculture	32.2	61.0	6.8
Agriculture	32.1	63.2	4.7
Mass Media Exposure			
No	31.8		60.3
Yes	30.7		62.4

Background Characteristics	Energy deficiency	Normal	Overweight
Decision on health			
Respondent alone	31.5		61.0
others	31.7		60.4
Fuel used for cooking			
Smoke less fuel	32.1		61.3
Smoke producing fuel	30.8		60.2
Violence			
No violence	31.8		60.1
Faced violence	30.6		63.0

Nutritional Status in Madhya Pradesh Evidence from NFHS-2 and NFHS-3

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Introduction

India is home to the largest number of severely malnourished people in the world. The malnourished people in India are located in urban, but more so in rural areas where income and food security is low. Around 26 per cent of the Indian population is below poverty line while 70 per cent live in rural areas.

Life expectancy at birth is higher in women than in men in most of the developed countries and in some of the developing countries. In India, however, women and men have nearly the same life expectancy at birth. The fact that the typical female benefit in the life expectancy is not seen in India suggests there are systematic problems with women's health. Indian women have high mortality rates, particularly during childhood and during their reproductive years. The poor nutritional status of women has repercussions not only for them but also for their families.

Nutritional status refers to the health condition of an individual as it is identified by nutrients' intake and their utilisation. A person can be classified as normal or malnourished on the basis of his or her nutritional status. Malnutrition can further be characterised into under nutrition, specific nutrient deficiency, over nutrition, and nutritional imbalance (Jelliffe, 1966).

Anthropometric measurements provide an indirect assessment of body composition and nutritional status. Rao (1980) has shown that among anthropometric measurements, height and weight are the most

important indicators of nutritional status. Arokiasamy (1997) argues that *weight-for-age* is a measure of current nutritional status, while height-for-age is a measure of chronic nutritional status. The Body Mass Index (BMI) is widely regarded as a good measure of nutritional status of an individual. It can be used to measure both thinness and obesity. Mohanty and others (1992) have mentioned that BMI is a good indicator of nutritional status as well as an indicator of the energy stored in the body. Height and weight are the measurements used to compute the Body Mass Index.

In this paper, we attempt to analyse the change in the nutritional status of women and food intake patterns in Madhya Pradesh in the recent past on the basis of the information available through different rounds of the National Family Health Survey (NFHS).

Data

The present study is based on the information available through the National Family Health Survey. NFHS provides information about family planning, and reproductive and child health programs, both nation wide and in individual states along with estimates of various demographic parameters. It also provides information about the food intake, height and body mass index (BMI) of women. For this study we have considered the data available through NFHS-2 and NFHS-3 which refer to the year 1995 and 2005 respectively.

Changes in Consumption Patterns

The consumption of nutritious food is very important for a person to maintain good health. Agriculture progress in the last two decades has made India self-sufficient in food grains. Yet, under nutrition continues to be a major concern, especially in rural population and in states like Bihar, Madhya Pradesh, Orissa, West Bengal, Rajasthan, etc. The food intake of individuals varies by demographic and socioeconomic conditions. Many studies have analysed food consumption patterns in India (Chatterjee et al 2006, Kumar 1998, Radhakrishna and Ravi 1992). These studies have observed that there has been a clear shift from grain consumption towards consumption of non-grain food and animal products in recent decades. Consumption of special food such as milk, fruits, vegetables etc. during pregnancy has also been observed in several studies (Mishra and Tiwari 1990, Chawla et al 1997). Turan and Sardan (2001) have observed that the consumption expenditure in cereals and cereal substitutes have decreased which indicates an overall

improvement in the income level of the masses. Indians living in rural areas appear to have started spending more on pulses, milk and milk products, edible oils, meat, egg, fish and vegetables.

Changes in consumption patterns between NFHS-2 and NFHS-3 can be compared for women in Madhya Pradesh. Married women aged 15-49 years were asked during the survey about the frequency of consumption of specific food items such as milk, pulses or beans, green leafy vegetables, other vegetables, fruits, meat or fish, egg and chicken, etc. Tables 1a and 1b show the proportionate distribution of women by the frequency of consumption of specific food items in Madhya Pradesh and in India. At NFHS-2, about one fifth of the women surveyed in India reported that they consumed milk/curd daily whereas this proportion increased to more than 26 per cent at NFHS-3. In Madhya Pradesh, this proportion was lower than that in India. The proportion of women reporting consumption of pulse/beans and green leafy vegetables also increased over time. By contrast, the proportion of women reporting consumption of fruits in Madhya Pradesh and in India was not only poor but have also decreased over time. The proportion of women surveyed who reported consumption of fruits occasionally has also reduced significantly between NFHS-2 and NFHS-3. Similarly, consumption of eggs/chicken/meat/fish has also decreased in NFHS-3 compared to NFHS-2.

Change in the Nutritional Status

According to the International Dietary Energy Consultative Group of United Nations, BMI is a good index to grade chronic energy deficiency in adults. The group has classified chronic energy deficiency in adults into three categories on the basis of BMI - less than 16; 16-17 and 17-18.5 (Government of India 1995). A BMI<18.5 is a reflection of chronic energy deficiency. Females with BMI between 18.5 and 20.0 are considered as undernourished while those having a BMI in the range 20 to 25 are considered to be in balance. On the other hand, women with a BMI of more than 25 are termed as overweight while those with a BMI >30 are termed as obese (Griffiths and Bentley 2001).

There are many studies that have analysed the nutritional status of women in different parts of India (Thimmayamma et al. 1981; Busi and Sai Leela 1996, Arokiasamy 1997, Bhargava and Kawatra 1999, Nutrition News 1997). Srivastava and others (1998), and Nigam (1999) have studied the nutritional status of females in Uttar Pradesh and reported high prevalence of under nutrition. Relatively poor nutrition

situation has also been reported by Krishneswamy and others (1997) and Rao (1996) in studies conducted in South India. Tiwari and Satyanarayana (2008) in their comparative analysis of nutritional status of BIMARU states and five other developed states of India have concluded that the proportion of women with balanced nutrition is comparatively higher in the BIMARU states than in other states.

Table 2 shows the distribution of women surveyed according to BMI in Madhya Pradesh. More than 38 per cent of women surveyed had a BMI of less than 18.5 in NFHS-2 which increased to almost 42 per cent in NFHS-3. This indicates that the nutritional deficiency in women of Madhya Pradesh is not only very high but it has increased over time also. It is also clear from the table that proportion of women with BMI ranging from 18.5 to 20.0 increased marginally in the state between NFHS2 and NFHS-3. By contrast, the proportion of women having a BMI of 20-25 decreased from 34 per cent in NFHS-2 to 29 per cent in NFHS-3 which again reflects that the nutritional status of women in the state has deteriorated over time. At the same time, the proportion of overweight women - woman with a BMI ranging from 25 through 30 increased from about 1 per cent in NFHS-2 to more than 5 per cent in NFHS-3.

Rural-urban differentials in under nourished and obese women are significant. The proportion of under nourished women was found to be high in rural women as compared to their urban counter part whereas proportion of obese women was higher in urban than in rural women. What is even more concerning is the observation that the proportion of under nourished as well as obese women increased in NFHS-3 as compared to NFHS-2 (Table 3). On the other hand, the proportion of under nourished women in Scheduled Tribes was found to be twice as high as in other categories (Table 4). It may also be seen from table 4 that in all social categories, proportion of under nourished women as well as proportion of obese women appears to have increased over time. Similarly, the proportion of under nourished women was found to be the highest in Hindus and, once again, this proportion has increased between NFHS-2 and NFHS-3.

Conclusions

In this paper an attempt has been made to study the change in the nutritional status of women in Madhya Pradesh between NFHS-2 and NFHS-3. The analysis reveals that the problem of under nutrition in women of Madhya Pradesh is quite substantial and it appears to have

aggravated over time. The problem is particularly serious in the rural areas and in Scheduled Castes and Scheduled Tribes. In the urban areas, the problem of obesity appears to be gaining dangerous proportions. There are also indications of change in the dietary pattern. The consumption of milk and milk products appears to have increased that of fruits, eggs and chicken/meat/fish, etc. appears to have decreased.

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Table 1
Per cent distribution of women by frequency of consumption of specific foods (NFHS -2, NFHS-3) Madhya Pradesh.

Food item	Daily	Weekly	Occasionally	Never
	NFHS-2 (1998-99)			
Milk/Curd	20.4	12.2	50.2	17.3
Pulse/Beans	42.9	37.2	19.3	0.6
Green leafy vegetable	41.1	40	18.6	0.3
Other vegetable	53	33.2	13.4	0.4
Fruit	4.9	17.7	71.8	5.5
Eggs	0.9	10.7	36.9	51.5
Chicken/Meat/Fish	0.5	10.5	40.2	48.8
	NFHS-3 (2005-06)			
Milk/Curd	26.3	21.7	42.6	9.4
Pulse/Beans	54.5	38.8	6.6	0.1
Green leafy vegetable	38.1	50.1	11.6	0.3
Other vegetable	7.8	27.1	60.9	4.1
Fruit	0.4	11.7	31.9	56
Eggs	0.2	7.5	31.7	60.7
Chicken/Meat/Fish	0.2	6.4	33.8	59.6

Table 2
Per cent distribution of women by frequency of consumption of specific foods (NFHS -2, NFHS-3) India.

Food items	Daily	Weekly	Occasionally	Never
		NFHS-2		
Milk/Curd	37.5	17.4	34.1	10.9
Pulse / Beans	46.9	40.8	11.6	0.6
Green leafy vegetables	41.8	43.3	14.3	0.4
Other vegetable	65.1	28	6.6	0.2
Fruit	8.1	24.9	62.2	4.7
Eggs	2.8	25	37.9	34.2
Chicken/Meat/Fish	5.8	26.1	37.3	30.8
		NFHS-3		
Milk/Curd	39.8	15.6	33.2	11.4
Pulse/Beans	52.7	36.8	9.6	0.9
Green leafy vegetables	64.2	28.7	6.8	0.3
Other vegetable	12.7	27.2	56.6	3.5
Fruit	3.5	28.8	32.9	34.8
Eggs	39.8	15.6	33.2	11.4
Chicken/Meat/Fish	6.8	28.5	32	32.6

Table 3
Proportion of women in different category of body mass index.

BMI	NFHS-2		NFHS-3	
	Madhya Pradesh	India	Madhya Pradesh	India
<18.5	38.7	36.3	41.7	35.6
18.5-20.0	21.2	20.1	21.8	19.2
20.0-25.0	34	32.9	29.0	32.6
25.0-30.0	4.9	8.4	6.2	9.8
>30	1.2	2.3	1.4	2.8
Mean	19.77	20.26	19.69	20.47
BMI	NFHS-2		NFHS-3	
< 16.00	15.9	19	18.9	19.3
	Madhya Pradesh	India	Madhya Pradesh	India
16.00-17.00	24	25.2	26.8	25.6
17.00 -18.50	60.1	55.8	54.4	55.2
Mean	17.07	16.96	16.98	16.96
Minimum	12.08	12.03	12.83	12.04

Table 4
Distribution of women by body mass index and place of residence.

BMI	NFHS-2		NFHS-3	
	Urban	Rural	Urban	Rural
<18.5	28.3	42.3	32.5	45.4
18.5-20.0	17	22.7	16.6	23.9
20.0-25.0	38.7	32.7	32.3	27.6
25.0-30.0	12.6	2.2	14.4	2.9
>30	3.4	0.4	4.2	0.2
Mean	21.09	19.32	21.14	19.1

Table 5
Distribution of women by body mass index and caste.

BMI	NFHS-2				NFHS-3			
	SC	ST	OBC	Others	SC	ST	OBC	Others
<18.5	40.8	49.4	37.9	27.7	46.5	50.6	42.0	28.9
18.5-20.0	22.8	24.4	20.5	18.3	17.7	23.7	23.9	19.4
20.0-25.0	34.0	24.9	36.7	38.5	30.2	24.0	28.2	34.2
25.0-30.0	2.1	1.4	3.7	12.4	4.9	1.4	5.3	13.3
>30	0.3	0.0	1.1	3.1	0.7	0.2	0.7	4.3
Mean	19.4	18.82	19.77	21.03	19.39	18.76	19.49	21.18

SC Scheduled Castes
ST Scheduled Tribes
OBC Other backward classes

Table 6
Distribution of women by body mass index and religion

BMI	NFHS-2			NFHS-3		
	Hindu	Muslim	Others	Hindu	Muslim	Others
<18.5	39.1	33.6	35.9	42.4	37.4	28.7
18.5-20.0	21.7	18.2	12.1	22.2	19.6	14.3
20.0-25.0	33.9	36.6	32.7	29	24.7	37.7
25.0-30.0	4.4	8.0	16.3	5.2	14.7	15.6
>30	1.0	3.7	3.1	1.1	3.6	3.8
Mean	19.7	20.57	20.88	19.56	20.68	21.17