Regional Disparities in Health - An Analysis of Infant Mortality Trend in Andhra Pradesh.

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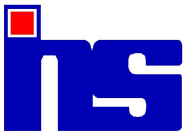

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Abstract

The Infant Mortality Rate is a sensitive indicator of infants health, population health, socio-economic development as well as the availability, utilisation and effectiveness of health care, particularly perinatal care. This study of IMR trends in the state of Andhra Pradesh, India is based on analysis of the time trend of IMR estimates from Sample Registration System, Census, and National Family Health Survey.

The Infant Mortality Rate of the state registered a consistent decline from 110-120 in 1970s to 66-70 in 1990s. But wide variation between and within districts remain. Rural urban differences in mortality has either remained as such or may have increased. Socioeconomic conditions and female literacy rate play a key role in reducing Infant Mortality Rate. House-hold standard of living and better infrastructure development of an area appears to be associated with lower Infant Mortality Rate. Mothers age at birth and closely spaced births are important risk factors for infant mortality.

Large disparities in health status of people in the state continue to exist. The health status in rural areas seems to be deteriorating over the past decade. Small area mortality analysis would enable the state to identify areas requiring development. This would facilitate area plans that may reduce inequality in health status and spread socioeconomic development.

I. Introduction:

The Infant Mortality Rate (IMR) is a sensitive indicator of infants health, population health as well as socio-economic development. In addition, IMR is a sensitive indicator of the availability, utilisation and effectiveness of health care, particularly perinatal care (WHO, 1981). The Andhra Pradesh state is making efforts to expedite human development and improve health status. Health and family welfare is an important aspect of the Government's vision to improve the quality of life in the state. The states Vision 2020 document emphases IMR as one of the key health and development indicator. This study analyses long term trend of IMR in Andhra Pradesh and smaller areas. We then review available evidence on mortality differentials by socio economic status. We then consider possible strategies and interventions to reduce regional disparities and improve the overall child survival potential in the state.

II. Materials and Methods:

The analysis is based on secondary data and corresponding mortality estimates. To understand the long term trend, time series data from Sample Registration System (SRS) for

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Andhra Pradesh and other neighbouring states was used. Another set of data from the two National Family Welfare Surveys (NFHS) was taken to understand the IMR in AP, India and other states. The rural urban difference in IMR was analyzed by using the same time series data from SRS and the two NFHS. Estimates from the population census of 1981 and 1991 and sub district level estimates of IMR from a District Family and Health Survey (DFHS) was used to understand the regional and district wise differences in IMR. To examine mortality differentials by socio economic status, estimates from the two NFHS and Censuses were used.

For Andhra Pradesh, as in rest of India the most regular source of mortality estimate is the SRS. However, limited sample size of SRS does not allow for disaggregated estimates within the state. Another source of IMR is the Census. The population census of 1981 (RGI, 1980) introduced Brass (UN Manual-X, 1983) type questions about number of children ever born and surviving etc. An advantage of the census data is that district level estimates are feasible because of large sample size. Indirect estimates of child mortality at the district level have been made from census data, using children ever born technique. But the time location is not accurate in these indirect estimates and intervals between successive estimates is long.

The existing data sources do not allow estimation of IMR for small area or stratification by socio-economic status. Recently attempts have been made in Andhra Pradesh to estimate IMR at the district and sub district level. A District Family and Health Survey (DFHS) was conducted to provide district and sub district level estimate of infant mortality, fertility and maternal mortality using indirect estimation techniques. Other sources include the Annual Vital statistics based on the Civil Registration System. These estimates are unreliable owing to the incompleteness of registration and differential registration of births and deaths.

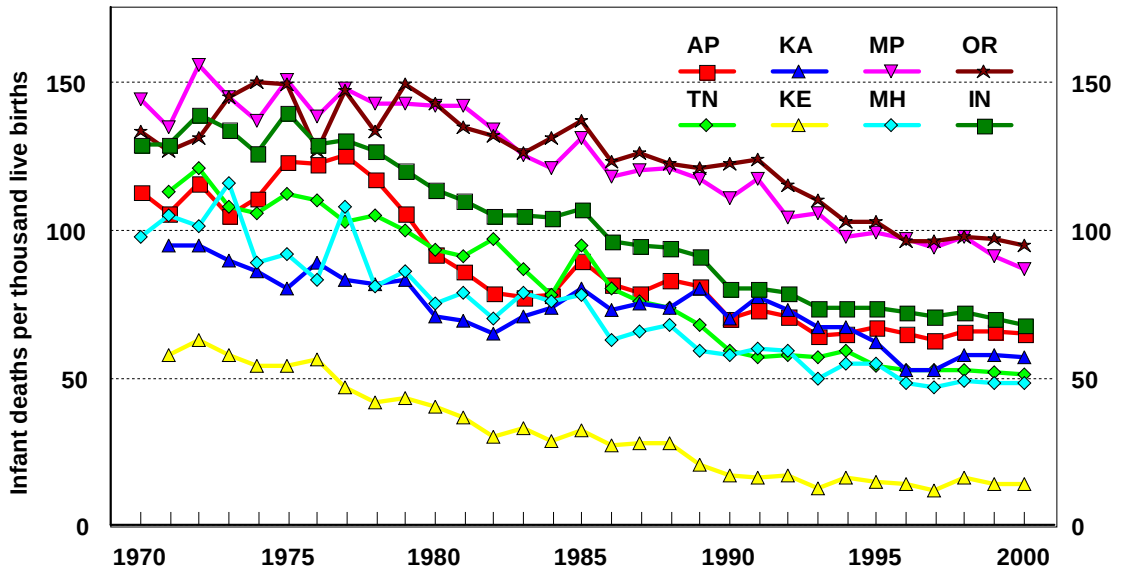
The National Family Health Survey (NFHS) estimates are available for households stratified by a few socio economic characteristics. But the NFHS sample size is small. Thus stratification by socioeconomic status reduces accuracy of estimates. Hence our results on mortality differentials by socioeconomic status have to be interpreted cautiously.

III. Results:

A. IMR Time Trend

The estimates from SRS show that IMR in the state registered a consistent decline from 110-120 in 1970s to 66-70 in 1990s (Figure 1). The All India (dark green line in figure 1) estimate of IMR was about 130 during the 1970s and declined to about 70-80 during the 1990s. The reduction of IMR in AP (red line in figure 1) has by and large kept pace with the national trend. However performance of the state has been much less than that of the neighboring states. Kerala started with a lower level of IMR during the 1970s and has experienced consistent improvements over time. Tamil Nadu started with a level of IMR similar to AP. The decline of IMR in Tamil Nadu is higher than in AP. Both states started with similar levels of IMR in 1970s and improved more or less similarly during the 1980s. During 1990s, Tamil Nadu continued its improvements in IMR but Andhra Pradesh appears to have slowed down, resulting in a gap of about 10 infant deaths per 1000 live births between the two states. Orissa (brown line in figure 1) also shows decline in IMR from 149 in 1975 to 97 in 1999. In Madhya Pradesh (light blue in fig 1) there was an increase in IMR in 1975 but again declined in 90s to about 97 in 1999.

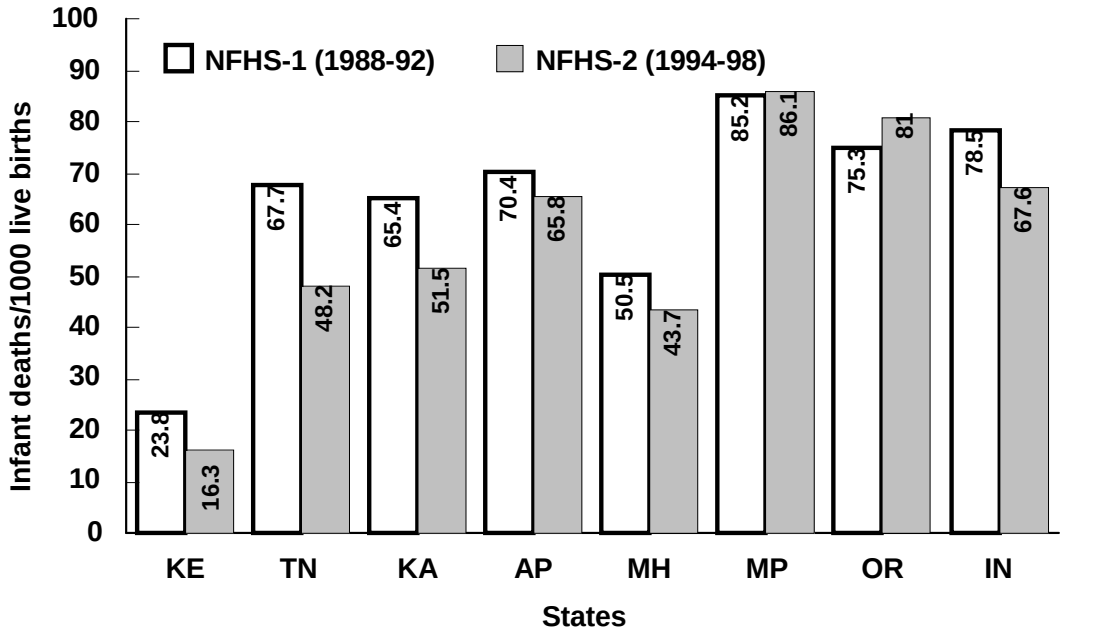
Figure 1: Infant mortality trend in AP and other neighbouring states



Source[4]: SRS Annual Reports, 1970 - 2000.

Andhra Pradesh has experienced significant reduction in IMR, over the past three decades. But it has definitely not been able to exploit the full potential available to it. Of particular concern is the slow down in reduction of IMR in the state, during the 1990s.

Figure 2 :IMR trend in AP and other states according to NFHS-1&2



Source[5,6]: NFHS-1 data from IIPS(1995) Table-8.8 p221; NFHS-2 data from IIPS(2000) Table-6.6 p194

The NFHS surveys in 1992-93 and 1998-99 provide an independent estimate of IMR and its trend. The figure 2 shows IMR from the two NFHS-India (NFHS-1 India, 1995; NFHS-2 India, 2000) surveys. The time trend and comparative position of AP vis a vis to other South Indian states is similar to the estimate from the SRS presented earlier in Figure 1. IMR in AP is slightly lower than the national average and is higher than other south Indian states. The decline in IMR between NFHS 1 and 2 is more marked for Kerala, Tamil Nadu,

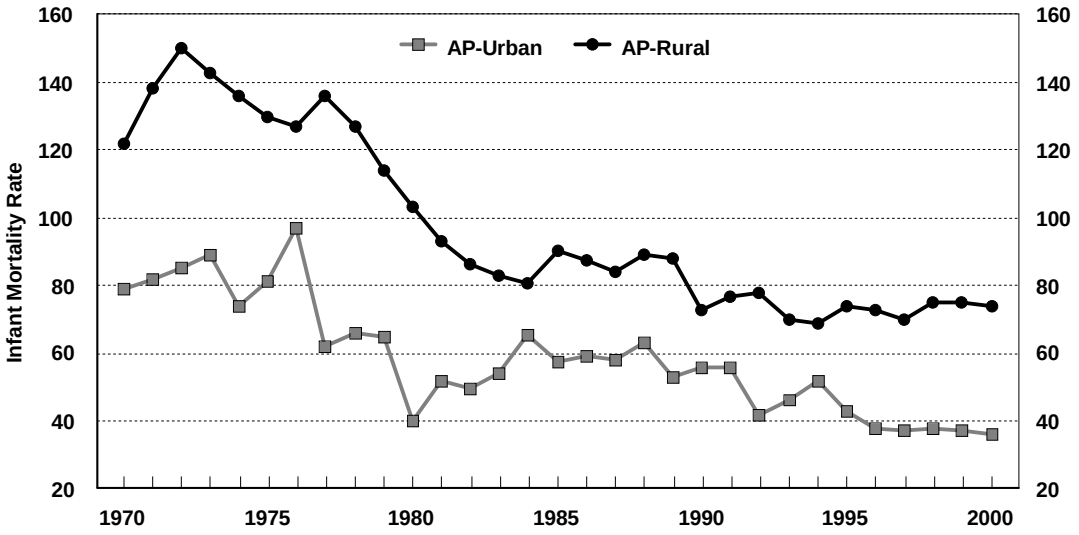
and Karnataka. Infant mortality in AP declined from 85 deaths per 1000 live births during 1984-88 to 66 deaths per 1000 live births during 1994-99, an average rate of decline of nearly 2 infant deaths per 1000 live births per year. A comparison of the IMR of India during the 1988-1992 (0-4 years before NFHS-1) and 1994-98 (0-4 years before NFHS-2), suggests an improvement in survival by about 11 children per 1000 live births. But Andhra Pradesh in the same period shows a smaller gain of only 4 additional lives saved per 1000 live births.

Another important fact is that the absolute level of IMR continues to be unacceptably high. Despite the overall decline in infant and child mortality, 1 in every 15 children born during the mid 1990s i.e., five years before NFHS-2 died within the first year of life. Clearly, child survival programmes in AP need to be intensified to achieve further reductions in infant mortality.

B. Rural Urban Difference in IMR

In Andhra Pradesh rural infant mortality rates are considerably higher than urban mortality rates. Infant mortality in rural areas is almost double that of urban areas. There was a sharp decline in IMR during the 1970s both in the rural and urban areas. The decline in rural areas must have been greater since the rural urban gap has reduced from about 43 infant deaths per 1000 live births during the 1970s to about 15 infant deaths per 1000 live births in 1980s. However the trend of reducing rural urban gap in the 1980s appears to have been lost or probably reversed during the 1990s.

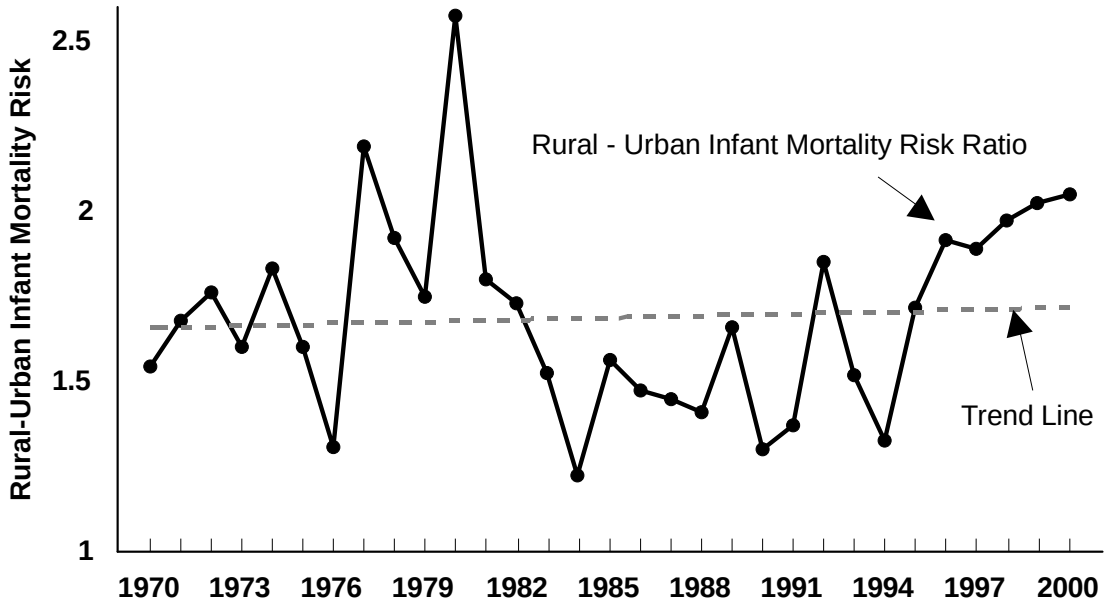
Figure 3: Infant Mortality Rate in Urban and Rural areas of Andhra Pradesh



Source[4]: SRS 1970 to 2000

Considering that the absolute level of infant mortality has been decreasing, some reduction in the rural urban rate difference is to be expected, even if there is no change in the relative risk of infant mortality between them. To examine if this is the case we have computed relative risk of infant mortality in rural areas of the state compared to the urban areas (RUIMRR). This is simply the ratio of IMR in rural and urban areas respectively. Thus; RUIMRR = IMR Rural / IMR Urban. RUIMRR = 1, means that there is no difference between rural and urban areas. RUIMRR < 1 would mean that infants in rural areas have better chance of survival. RUIMRR > 1 means that rural areas are worse. Increasing RUIMRR means that the rural urban difference is worsening and decreasing trend of RUIMRR means that the rural urban gap is narrowing.

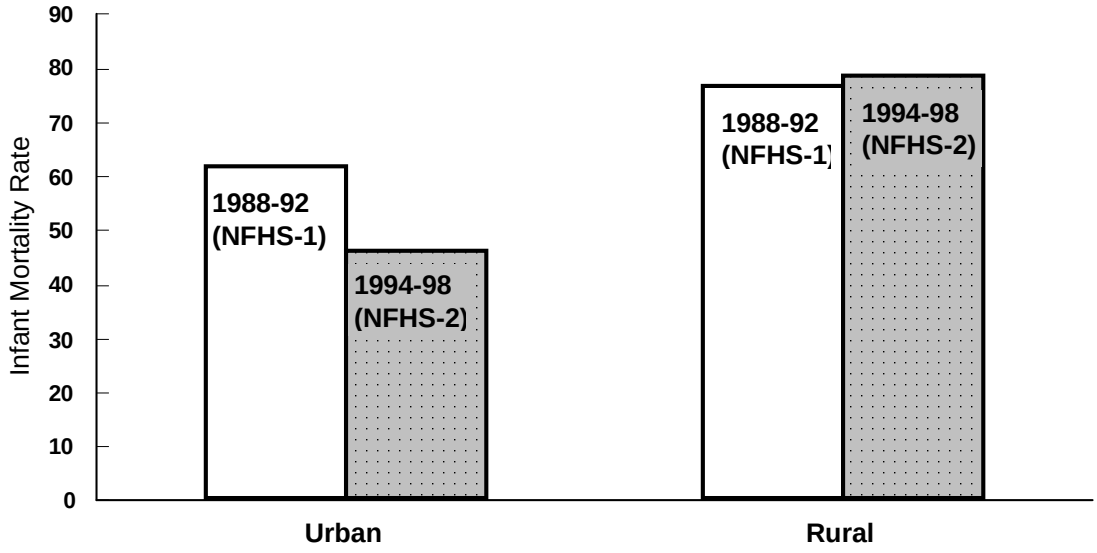
Figure 4: Rural -Urban Infant Mortality Risk Ratio



Source[4]: SRS 1970 to 2000

Figure 4 shows the time trend of rural urban Infant Mortality Risk Ratio for AP. The long term trend line is almost horizontal suggesting that the rural urban gap in health status has remained as such. The slight upward tilt of the long term trend line and the increasing trend of RUIMRR during the later half of 1990s suggest that the Rural Urban gap may actually have widened during this period. Statistics from the NFHS also corroborate this interpretation.

Figure 5: IMR in Urban and Rural areas of Andhra Pradesh, NFHS



Source[7,8]: NFHS-1 data from p-132, table no:8.4. and NFHS-2 data from p-120 table- 6.3

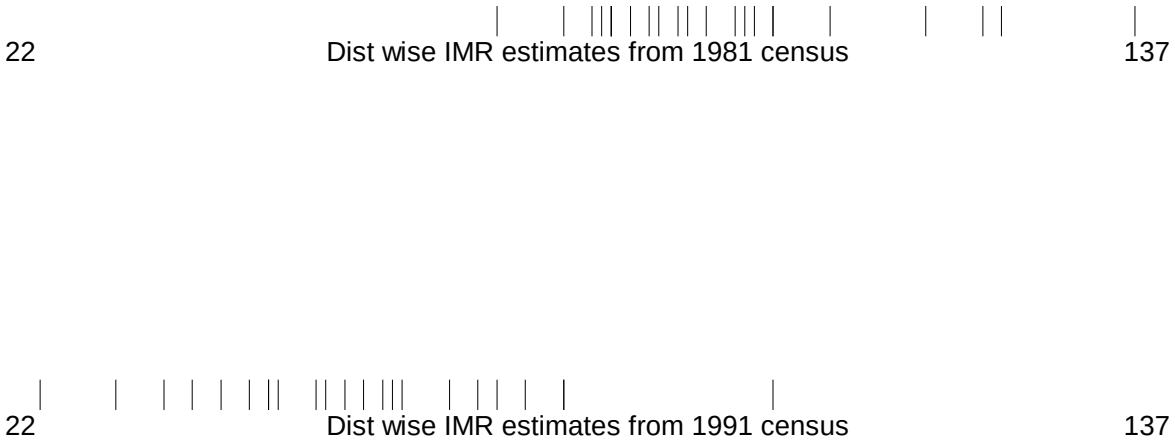
Figure 5 shows that IMR in urban areas declined from 62 in 1992-93 to 46 in 1998-99. But the rural IMR stagnated around 79 between the two surveys (NFHS-1, 1995; NFHS-2, 2000). The widening rural-urban gap is evident. The NFHS estimate of increasingly urban

rural difference is consistent with SRS estimate of widening rural urban gap during the late 1990s.

C. Regional difference by districts

The population census (RGI, 1997) of 1981 and 1991 provide indirect estimates of infant mortality at the district level. Figure 6 shows one way scatter plot of district level IMR estimates from 1981 and 1991 census respectively. The scale of both scatter plots (1981 and 1991 census) have been fixed between 22 and 137. Estimates used to generate Figure 6 are given in Table 1.

Figure 6: One-way scatter plot of district wise IMR estimates. Each vertical bar represents the estimate for one district



Source[9]: RGI, Occasional Paper No.1 of 1997, Table-3.1, p-114. See table-1 in this paper.

These estimates bring out three important characteristics of infant mortality risk prevalent in the state. Firstly, the IMR has reduced in all districts. The band of one way scatter plot of district level estimates from 1981 census are towards 137 end of the plot. The estimates from 1991 census are scattered towards the lower side of the range. Secondly, there is wide inter district variation and disparity in levels of child health status. The district level IMR ranged from 70 to 137 in 1981 i.e, a difference of 67 infant deaths/1000 live births and 22 to 99 in 1991 which amounts to a difference of 77 infant deaths per 1000 live births. Thirdly, the inter district disparity appears to be increasing instead of narrowing. The difference between lowest and highest mortality districts increased from 62 infant deaths/1000 live births around 1981 census to 77 infant deaths per 1000 live births around 1991 census.

Table 1: District level indirect estimates of IMR from 1981 and 1991 census.

District	IMR-1981	IMR-1991	District	IMR-1981	IMR-1991
Hyderabad	82	22	Ranga Reddy	82	56
Krishna	92	30	Nalgonda	90	58
Karimnagar	81	35	Warangal	99	59
Guntur	80	38	Chittoor	115	60
Nizamabad	70	41	West Godavari	84	65
Cuddapah	105	44	Kurnool	96	68
Nellore	86	46	Anantapur	121	69
Prakasam	89	46	Visakhapatnam	97	73
Khammam	87	47	Mahaboobnagar	99	77
Adilabad	95	51	Srikakulam	123	77
Medak	82	52	Vizianagaram	137	99
East Godavari	77	54	**Inter district Variance**	**259**	**293**

Source[9]: RGI, Occasional Paper No.1 of 1997, Table-3.1, p-114

D. Small Area Analysis of IMR - Sub district level

Table 2: District and divisional level estimates of IMR with 95 % Confidence intervals in three districts of AP.

District / division	Census estimates		DFHS 1998-2000.	
	1981	1991	IMR	(95 % CI)
Nellore Dt.	86	46	79	(71 - 87)
Gudur Div.			92	(70 - 115)
Kavali Div.			58	(37 - 79)
Nellore Div.			81	(59 - 103)
Chittoor Dt.	115	60	65	(59 - 72)
Madanapally Div.			76	(60 - 92)
Chittoor Div.			67	(46 - 89)
Tirupati Div.			45	(27 - 62)
Mahbubnagar Dt.	99	77	115	(107 - 122)
Gadwal Div.			93	(60 - 127)
Mahbubnagar Div.			110	(91 - 128)
Narayanpet Div.			125	(102 - 147)
Wanaparthy Div.			62	(35 - 89)
Nagarkurnool Div.			140	(117 - 163)

Source[10] : Mahapatra, Rao, Kumar. District Family Health Survey, IHS RP-08/2001.

Estimates of IMR below the district level are not easily available. The SRS sample size is not large enough for disaggregated estimates below the state level. Vital registration data would have been an useful source for small area estimates, but it suffers from gross under reporting. A District Family Health Survey[10] was piloted in three districts of AP to estimate IMR of divisions within the districts. This study shows substantial area wise variations in IMR.

The district and division level IMR estimates from this study shown in Table 2 provide useful insights about differences in health status by geographical regions. Clearly the IMR is significantly higher in Mahboobnagar district at 115 per 1000 live births as compared to 65 and 79 in Chittoor and Nellore districts respectively. Infant mortality level in Nellore district (71-87 per 1000 live births) is close to the state average of 75 according to SRS 1999, and 72 according to NFHS, 1998. Chittoor has a slightly better situation with comparatively lower infant mortality.

Mahboobnagar is clearly much worse compared to the state level IMR. Obviously there are important socioeconomic and geographic differences in mortality experience of people in different parts of the state. Going down to the division level, the DFHS[10] study found that four of the five divisions in Mahboobnagar district have IMR that is higher than the state average, and in Wanaparthy division only the IMR is comparatively lower. The IMR estimate for Nagarkurnool division is as high as 140 per 1000 live births corresponding to the state average IMR in the 1960s. Thus there appears to be a wide regional variation in infant mortality with in the state. Some areas of the state are clearly three to four decades behind in terms of their survival experience. This shows the need for districts and divisional level estimates of IMR and its importance to know the exact determinants of IMR and to develop area specific interventions to reduce IMR.

E. Difference in IMR by Socioeconomic status

Disaggregation of IMR estimates by socioeconomic status of the household is feasible only if both mortality and socioeconomic status data are available at the household level. The NFHS collected data on socioeconomic status of households and mortality experience. Table 3 shows the infant mortality rates according to mothers background obtained from the NFHS-Andhra Pradesh. Infant mortality declines substantially with increase in the standard of living. In households with a high standard of living the infant mortality rate was 43 deaths per 1000 live births and in households with a low standard of living the IMR was 97 deaths per 1000 live births (NFHS-2). The scheduled castes and scheduled tribes have higher rates of infant mortality compared to other backward classes and others.

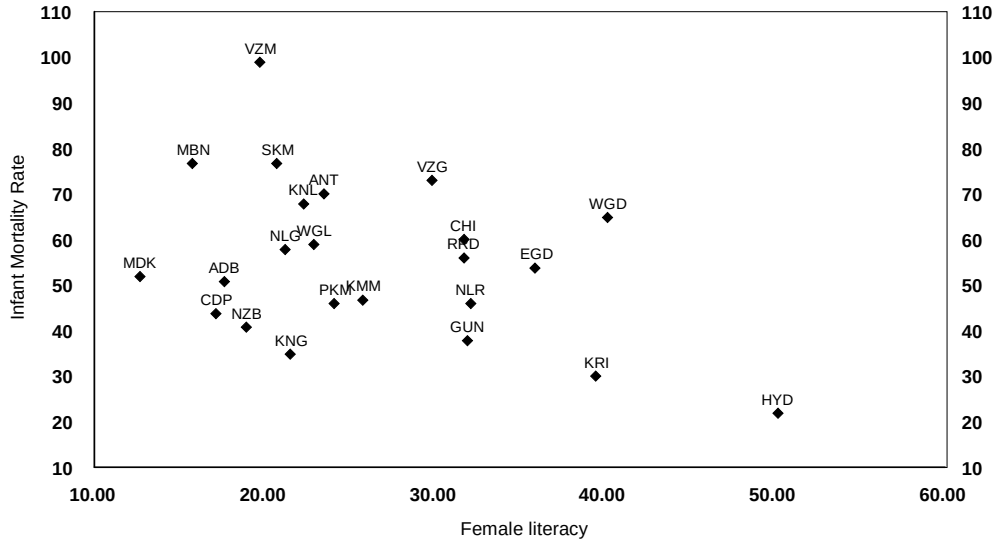
Table 3: Infant mortality by background characteristics

Background	IMR	Background	IMR
Mother's education		Standard of living index	
Illiterate	82.4	Low	97.1
< middle school	53	Medium	56.8
High school and above	48.9	High	42.5
Social status			
Scheduled caste	95.4	Backward classes	69.7
Scheduled tribe	103.6	Other	47.1

Source[8]: NFHS-2 (Andhra Pradesh) p-120, table-6.3

The infant mortality rate declines sharply with increasing education of mothers, ranging from a high of 82 deaths per 1000 live births for illiterate mothers to a low of 49 deaths per 1000 live births for mothers who have at least completed high school.

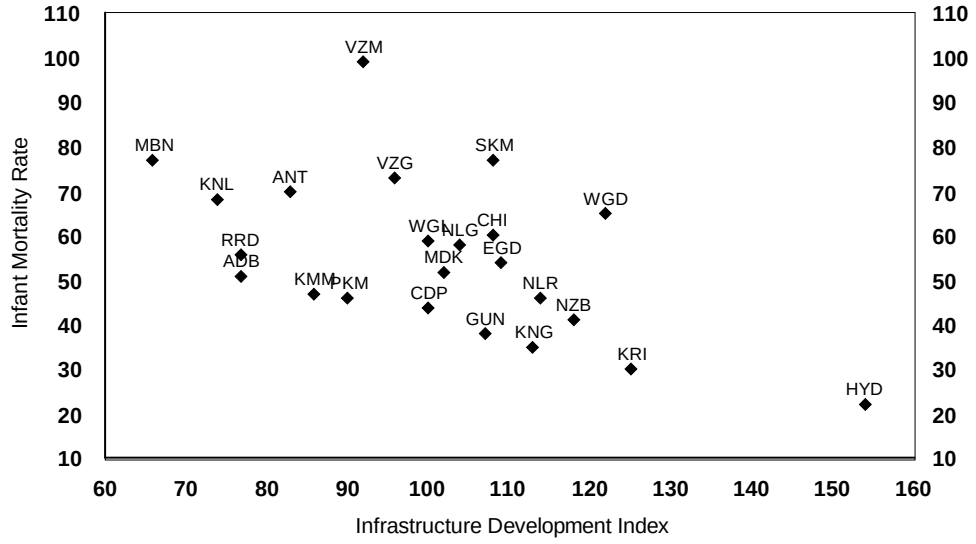
Figure 7: Female literacy rate and IMR in districts of AP, 1991



Source:RGI, Census 1991. IMR = 1991 census, indirect est. Female literacy = 1991 census direct est.

The NFHS estimates are based on stratification of sample households by literacy status. This is ideal. But the problem with NFHS is its small sample size. The sample size reduces further as we stratify the sample by socioeconomic status. Another way to study these relationships is to correlate socioeconomic indicators with mortality levels by small areas. Many other factors, apart from household level exposure, will affect both the socieconomic variables and mortality experience of a small area. Hence analysts generally attach lesser importance to correlational analysis compared to household level relationships between socioeconomic variables and mortality experience. However, these area wise estimates are generally based on larger sample size and hence are more reliable. The decennial census (Census of India - Andhra Pradesh, 1991) provide us with district level indirect estimates of IMR and direct estimates of female literacy level. In Figure 7 we have plotted female literacy ratio and IMR. The pattern of low IMR associated with high levels of female literacy is clearly visible.

Figure 8: Infrastructure development and IMR in districts of AP, 1990s.

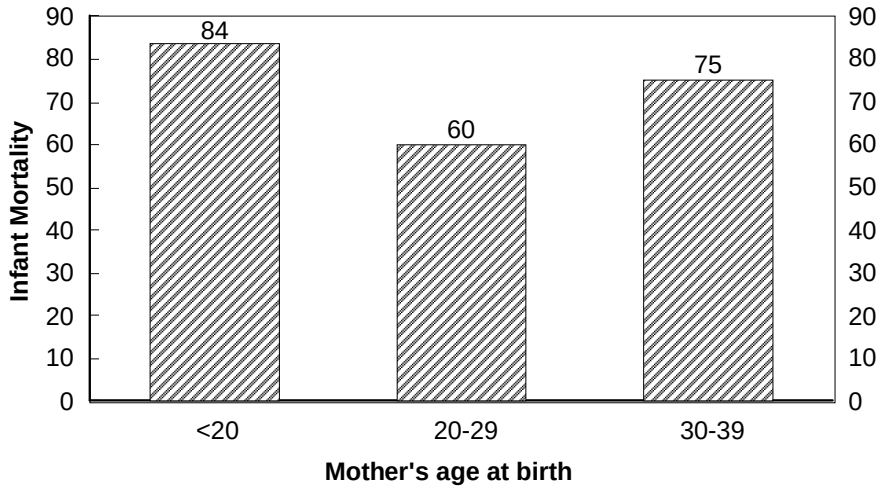


Source:Infr. Dev. Index is for 1995 taken from CMIE, 2000. IMR - 1991 census indirect est..

To examine relationship of IMR with socioeconomic development the Center for Monitoring Indian Economy (CMIE, 2000) infrastructure development index was plotted against IMR from 1991 census (Figure 8). The pattern is similar to the previous plot of female literacy rates and IMR. Districts like Hyderabad, Guntur that have high infrastructure development index show low IMR. Districts with low infrastructure development index like Mahboobnagar, Vizianagaram have high IMR.

Age of the mother is an important risk factor for infant and child mortality. Children born to mothers under 20 yrs of age are approximately 1.5 times more likely to die before their 1st birthday than children born to mothers in their 20s. Children born to young mothers are more likely to be premature, to have low birth weights, and to have delivery complications. Children born to mothers over the age of 40 are also at higher risk of death for a number of reasons, including an increased likelihood of congenital abnormalities and an increased likelihood of closely spaced births (McDevitt and others, 2002).

Figure 9: IMR by Mother's age at birth in Andhra Pradesh for the year 1998

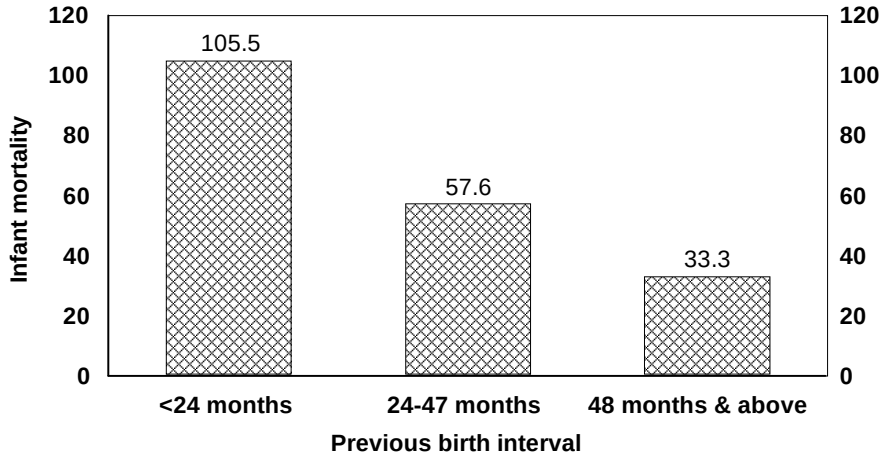


Source[8]: NFHS-2 (AP), p-121, table-6.4

In AP, Infant mortality is 40 percent higher among children born to mothers under the age of 20 than among the children whose mothers are age 20-29 (84 deaths compared with 60 per 1000 live births). The age at which a women bears the first child affects these rates. IMR and MMR are high in the women who gave birth when they were between 15-19 years of age. The main contributing factor for this is their physiological growth which does not cater to the growing needs of the pregnancy. The low nutritional status also plays its part. As the age at marriage increases the child bearing age also increases and hence will aid to lower the IMR and MMR.

Figure 10 shows the infant mortality rates according to previous birth interval. Clearly births spaced less than 24 months after the previous child birth have a higher risk of infant mortality. The timing of successive births has a powerful effect on the survival chances of children in Andhra Pradesh. Infant and child mortality rates decrease as the length of the previous birth interval increases. When the intervals between births was 48 months and above the IMR is 33 and when the interval between births is less than 24 months the IMR increases more than three fold to 106 (NFHS-2).

Figure 10: Infant mortality by previous birth interval in Andhra Pradesh



Source[8]: NFHS-2 (Andhra Pradesh) p-121, table-6.4

IV. Summary and Conclusion:

The IMR in Andhra Pradesh declined from 110-120 in 1970s to 66-70 in 1990s. But the improvements in the IMR appears to have slowed down during the 1990s. This is worrisome, considering the fact that IMR is a fairly sensitive indicator of socio economic development. Our analysis shows that correlation of IMR and socio economic characteristics in AP is on expected lines. So the question is what could be the reason for the slowing down of the reduction in IMR?

The Rural Urban gap appears to have widened during the late 1990s. Inter district differences in IMR has not reduced. Rather the inter district disparity appears to be increasing instead of narrowing. Within a district also large variations are noted among the divisions. It is plausible that the widening rural urban gap, increasing inter district disparity and persisting area specific differences within districts is contributory to the slow down in reduction of IMR. Clearly equity in health status is at issue. But more importantly balanced socioeconomic development of all areas of the state is fundamental to overall development, as well as equitable health status.

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