MORTALITY PATTERN OF INDIA : A TEMPORAL AND SPATIAL ANALYSIS

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Dedicated To

Didi...My Mother-in-Law

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CERTIFICATE

This is to certify that this dissertation entitled **MORTALITY PATTERN OF INDIA : A TEMPORAL AND SPATIAL ANALYSIS**, submitted by **SUNITA KANTH**, in the Partial fulfillment of six credits out of total requirement for the award of degree of **MASTER OF PHILOSOPHY** is a bonafide work to the best of my knowledge and may be placed before the examiner for evaluation.

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CHAPTER - I

INTRODUCTION

1-1 Introduction

Although mortality declined considerably in worldwide after the second world war, it was remarkable in the developing countries. In 1950-1955 only five countries (Denmark, Iceland, Netherlands, Norway and Sweden) belonged to what is called the "Over 70s Club", that is, the countries in which life expectancy at birth is more than 70 years, but by 1980 - 1985, the number of these countries had increased to 47, with 9 in Latin America, 6 in Asia, 32 in Europe, North America and Oceania and none in Africa. In the third world countries Japan has the highest life expectancy, with 76.9 years. Not much further behind comes China, with a life expectancy of 67.8 years, followed by the main countries of Latin America (Argentina, Brazil, Mexico and Uruguay)) with the lowest life expectancy, including 17 countries in Africa South of the Sahara, plus only three Asian countries.

It is interesting to note that the growing differentiation in the mortality of the countries of the third world is a development of the past 30 years. In the early 1950s the Asian and African countries differed little in their mortality rates: 41.2 years against 37.8 years, a difference of 3.4 years. The difference is greater today, with life expectancy of 59.1 and 49.4 years respectively, a

gap of 9.7 years. The African countries have found improvement in health much more difficult to achieve than the Asian countries and more difficult still than the Latin American countries.

Table 1.1: World Trend of Life Expectancy at Birth

Countries	Years	
	1950-55	1980-85
Afghanistan	31.6	37
Ethiopia	32.9	40.9
Central African Republic	34	43
Chad	32	43
Japan	63.9	76.9
Iceland	72	76.8
Norway	72.7	76
China	40.8	67.8
Bangladesh	36	47.8
India	38.7	55.4
Pakistan	38.9	50
Sri Lanka	56.6	68.4

Source: World Population at the turn of century, U.N. 1989.

Where the Asian countries are concerned, at the beginning of the 1950s Bangladesh, China, India, Indonesia and Pakistan had similar levels of life expectancy, roughly 37 - 40 years; China's lightning advance, gaining 27 years of life expectancy in 30 years, achieved a historic record. During the same period life expectancy in India increased from 38.7 to 55.4 years, a substantial increment of 16.7 years, while in Pakistan by 11.2 years as per Table 1.1.

Afghanistan showed very modest increase of 5 - 4 years (UN: 1989).

As far as India is concerned one of the striking demographic feature, over the last three-quarters of a century, is decline in mortality. From about 45 per thousand in the early twenties, mortality has dropped to about 15 per thousand by the mid seventies. The fall in mortality rate in this period is impressive and can be attributed largely to the control of epidemics which took a heavy toll of life with the introduction of massive health programme and with the control and eradication of major epidemic and killer diseases such as plague, cholera, smallpox and malaria. Mortality rates in the country have been brought down to 15 per thousand by the mid 1970's and 10 per thousand in 1981 to 1991 as given in Table 1.2.

Table 1.2: Trend of Death Rates in India

Years	
1901-1911	42.6
1911-1921	47.2
1921-1931	36.3
1931-1941	31.2
1941-1951	27.4
1951-1961	22.8
1961-1971	20
1971-1981	15
1981-1991	10

Source: Health Information India, 1990.

This transition from a high to moderate level over a comparatively short span of time is noteworthy, when compared with the mortality trends in the developed world where mortality decline took place over more than a century and a half (Padmanabha: 1982).

In India studies in mortality are essential for an appreciation of the future prospects of population. It has been said that formulating the five-year plans for the country was severly handicapped due to lack of precise knowledge of the components of population at various levels - national, state, urban, rural etc. within India, mortality pattern varies.

Studies of mortality provide information about longevity and health of population. It helps us to identify those underprivileged segments of the population who experience higher mortality levels and improve our understanding of determinants of mortality and their interrelationships. (UN: 1985)

So for India, there is need to study the mortality pattern, which has wide interstate variation.

1.2 Unit of Study

India is a country with great diversity in demographic component like mortality. So this study will focus about the trend and pattern of mortality in India from the period

of 1970 to 1990 on the data based on sample registration system which started regularly in 1970 only. The study is based on state level. For 1970, only 13 states and in 1990, 15 states have been taken for the study.

1.3 Objective

The objectives of this study are;

1. To observe the trend of mortality in India from the period 1970 to 1990.
2. To observe the wide interstate variation, rural-urban and sex differential in mortality especially in life expectancy at birth, infant morality rate and child death rate.
3. To observe the effect of socio-economic variables on the spatial and temporal aspect of mortality.

1.4 Overview of Literature

From the point of objectives few literature reviews have been done. These have been classified into three groups:

a) Economic

b) Socio-Cultural

c) Infrastructural

Although they are grouped separately, sometime they are interrelated, e.g. economic factor poverty may affect infrastructural facilities like drinking water or health services.

Mosley and Chen identified a set of 14 intermediate variables grouped into five factors: maternal factors, environmental factors, nutrient available factors, injury factors and personal illness control factors. These factors directly influence mortality. All social and economic determinants must necessarily operate through these variables to affect child survival (1984). It is not clear how some of the variables classified by Mosley and Chen as intermediate variables can affect child mortality directly. e.g. each of the maternal factors - age, parity, and interval between pregnancies can, as indicated by Mosley and Chen, affect infant survival through its effects on maternal health. These maternal factors affect infant mortality indirectly such as quality of child care.

The economic, socio-cultural and infrastructural factors which are mentioned earlier cannot act in isolation. They interact with demographic factors like - population, rural-urban residence etc. While reviewing the literature, it is found that in developing countries, rural-urban areas are distinctively demarcated. The pattern of mortality is also very different. With urbanisation, the traditional value system get eroded through a simultaneous breakdown of joint families and greater exposure to infrastructural facilities like schools, hospital, media etc.

Research on mortality in developing countries has frequently shown that mortality is lower in the cities (Behm and Vallin: 1982 UN. 1985). Access to health care and the availability of recent medical advances have been suggested as reasons for the urban advantage (Davis: 1973 UN: 1985). This view implies that the majority of people in developing countries are subject to higher risks of mortality because they live mainly in rural areas (Behm: 1980 UN : 1985).

Yet, there is conflicting evidence. For example, n the United Republic of Tanzania, mortality at Dar-es-Salam was estimated to be higher in other urban areas, although this finding was attributed to a more complete register of deaths in the capital (Hogan and Jeivani; 1973). A similar finding was reported for the city of Sao-Paulo in the 1960s (Vallin; 1976 UN : 1985). Preston and Trussell (1982 UN : 1985) found that rural mortality was slightly lower than urban mortality in the Republic of Korea and Sri Lanka.

One of the frequently mentioned possible causes of the disparity is the availability of health resources (Puffer and Serrano: 1973 UN : 1985).

Throughout the world, there is a well-documented concentration of medical facilities in urban areas, but the maldistribution in less developed societies, where mortality levels are much higher, causes more hardship. Some studies

point out that even when facilities are available in rural areas, they are often ill-suited to deliver the primary health services needed by the rural population (UN: 1985). The importance of health resources for the urban advantage s mentioned in the case studies of Ghana, Nepal (Thapa and Rutherford: UN : 1985). Padmanabha (1982) discusses about the disparity in mortality in rural and urban areas in India. The rural death rate (17.3 percent) nearly 70 percent higher than the urban death rate (10.2 percent) during 70s. It is seen that manly 47 percent of the total deaths are attributable to deaths in the age group (0-4). Infant mortality rate constitute nearly 30 percent of total deaths. In rural areas 75 percent of births are attended only by untrained medical practitioners and others as against about 38 percent in the urban areas. It has been suggested that observed disparities in mortality reflect the very different socio-economic standards that exist between the countryside and the city in developing countries (UN: 1985). To illustrate, it has been pointed out that urban populations usually benefit from more and better health resources, but they also have a higher average income and are better educated than rural dwellers (UN : 1985). When income and education are controlled the gap between urban and rural mortality is considerably reduced (UN : 1985).

1.5.1 **Economic Factors**

These are basically related to the availability of resources. Low availability of resources leads to inequitable allocation of economic resources.

In the literature review our focus is generally on poverty and female work participation. Since our study is related with India, it is known that poverty is deep rooted in India. All our activities get affected by it.

Female work participation has been taken as increase in the family income which further affect the quality of life in family.

Poverty

In India poverty is deep rooted and it affects every aspect of living whether it is mortality or fertility. It also affects the quality of life.

Zachariah, Rajan, Sharma, Nair and Mishra (1982) while discussing the demographic transition in Kerala mention that economic condition of households have a significant effect on the mortality rates of the children in the household. Families which can take care of themselves with respect of their basic needs such as food, clothing and housing have a much more lower infant mortality rate than families which cannot.

According to Visaria (1988) poverty indicates effect of poor health and nutrition of mothers during pregnancy. Poverty is likely to be associated with the low nurition level of mothers during pre-natal period, which is likely to be associated with low birth weight, and thus with high neo-natal mortality. While discussing about pregnant mortality in U.P. Khan (1988) found that the most important factor which affects is rampant poverty 40 to 50 percent of the rural population of U.P. live below the poverty line and do not get the minimum required calorie intake. Streuous physical labour, involving high consumption of calories, by pregnant women with low calorie intake, result in their severe malnutrition and abnormally low levels of hemoglobin. All these lead to premature labour, high peri-natal mortality and delivery of low weight babies.

One of the reasons low for mean age at marriage in U.P. is severe poverty (Khan: 1993). Malnurition shows the deep rooted poverty. The study (Sen and Sengupta: 1983) provided firm evidence of (i) remarkably high incidence of undernourishment even of the severe and disastrous types and, (i) systematic sex bias reflected in higher deprivation of girls vis-a-vis boys.

Murthy Guio and Dreze (1995) in this study proves that higher level of poverty are associated with higher levels of

child mortality at 10 percent level of significance. Contrary to Sen and Sengupta's (1983) study they proves that higher levels of poverty go with lower levels of female disadvantage in child survival.

The gender inequality in India tends to be relatively low among poorer households (Dreze and Sen: 1995).

According to the study done by Patel (1989) in urban slums of Bombay, malnurition of mother results in low weight babies. Low weight babies constitute 25 to 55 percent of total new born babies in various parts of India. The study shows the relationship of low weight babies and morbidity, weight gain and growth, from birth and followed upto 1 year. Mortality among low birth weight is three to four times higher than that of normal birth weight babies. These babies are more prone to thermolability metabolic maladjustments and have feeding problems (1989), and there is no major programme for support to undernourished mothers and for promotion of their health and nutrition (Gopalan: 1985).

Female Work Participation

The relation between employment of woman and the health and well being of children is not straightforward. This is because the attitudes towards women's work, the nature of that work and the conditions under which the work is

conducted vary greatly both among and within societies (UN: 1985). In perhaps the most common conceptualization, a mother's activity status has been regarded as a proxy for maternal time allotted to child bearing (Davanzo and Lee: 1978, 1985 UN : 1985). Those women who participate in the labour market are believed to spend the least amount of time in maternal activities. Those who do not participate at all are assumed to spend the largest amount of maternal time, and women who are engaged in market activities at home are thought to occupy an intermediate position. Reduction in maternal time devoted to child rearing may be directly related to infant or child mortality through the loss of specific elements in a desirable child care regimen or indirectly related through a deterioration in natural health (because of long work hours or deficient conditions of the work place) (UN: 1985).

Large negative effects of labour force participation by mothers were also found in an analysis of early twentieth century census data from the United Kingdom of Great Britain and Northern Ireland and the United States of America (Preston and others: UN 1985).

Farah and Preston (1981), in their recent study of the Sudan, found that children of working women had higher mortality rates than children of housewives. In cultures

that emphasize the importance of the mothers role as full-time caretaker, labour force participation may be symptomatic of economic stress in the household (UN : 1985).

Study of Beenstock and Sturdy (1990) say that the effect of female work participation on infant mortality is positive. The relative probability of infants dying is 27 percent higher among working mothers.

Krishnaji (1995) say that the female work participation is statistically significantly negative variable in explaining interregional variations in excess female child mortality. To some extent this is accounted by the fact that in the south female work participation rates tend to be higher, and gender differentials in mortality lower.

Higher female labour force participation improves the relative survival chances of girls vis-a-vis boys. But it does not tell us how female work participation affects the absolute levels of child mortality. There are at least two important effects to consider, working in opposite directions. First, involvement in gainful employment has many positive effects on a woman's agency roles, which often include child care. Second, the 'double burden' of household work and outside employment can impair women's ability to ensure the good health of their children, if only

by reducing the time available for child care activities (since men typically show great reluctance to share the domestic chores). In the case of girls, a third consideration is that higher levels of female labour force participation in the society may enhance the importance attached to the survival of female child. The analysis suggests a positive association between female work participation and under five mortality but this association is not statistically significant (Dreze and Sen: 1995).

For poverty it can be said that it affects mortality positively either as malnurition or any form but female work participation gives here two view: (i) It of course raise the family income, (ii) but sometime infant child mortality increases due to this because mother cannot give much time to child care.

1.5.2 Socio Cultural Factors

The socio-cultural factors have great impact on mortality pattern. This subject generally levolve around women. So that way it can be said that status of women affects the mortality pattern.

The various demographic and social phenomena we observed today relate to the women's position.

In fact Prof. A. Mitra (1978) believes that the female social status is perhaps the single most important element in comprehending India's demographic situation.

According to U.N. the status of women in society can be determined by her composite status which can be ascertained by the extent of control that she has over her own life derived from access to knowledge, economic resources and the degree of autonomy enjoyed in the process of decision making and choice at crucial points in her life cycle (Majumdar : 1974). And Indian women she has hardly any right of decision making in the family. She does not even have the right to make decision on her reproductive behaviour.

According to Sen about women's condition in India. The traditional family is a great compound of warmth on the one hand, and exploitation on the other. Non-perception of the deep inequalities that exist reflects the depth of these inequalities as well as serving to sustain them. Role education of boys and girls trains them implicitly for the inequalities of the respective positions (UNICEF : 1986).

The placing of women, including little girls in the position of persistent losers can be challenged and ultimately countered only by departing from the implicit acceptance of the losing role of the women (UNICEF : 1986).

In the above description we briefly mention about the status of women in Indian family. Since, 'she is half the sky (as the Chinese say, Coated by Jung A. : 1994)', her status may affect mortality pattern especially infant and

child mortality female literacy, mean age at marriage and sex differential in mortality is affected by her situation and vice-versa.

Sex Differential in mortality

Sex differential in mortality can be seen as a worldwide phenomena, but the extent of differences depends upon factors, like the level of development, modernisation, female participation in labour force, educational standard, social security system insurance, cultural and religious practice.

Sex imbalance in the population is not generated by natural or biological process but inequality in nutritional and medical care, Willful neglect of children of one sex can lead to differential mortality by sex and cause imbalance in a society (Gulati: 1987).

Countries with basic gender inequality include India, Pakistan, Bangladesh, China, West-Asia etc. (Dreze and Sen: 1995). In societies such as India higher female mortality for females is a reflection of the role and status of females, both within the family and in society at large, as much as they represent the health consequences of social, economic and cultural discrimination against them (Karkal: 1987).

Female infants receive much less care and attention than males. This is reflected in such practices as dressing female infants in less warm clothes thann the male infants. They are less carefully massaged with mustard oil as a prophylactic against the colds and chills to which the greater part of mortality amongst young children in India is due, she is not so well fed as a boy would be, and when ill, her parents are not likely to make the same strenuous efforts to ensure her recovery (Bhatia: 1983).

The Khanna study in Punjab demonstrated that prior to death, the female members of the community had less frequently received medical attention than the male members. Similar observation have been made in the rural areas of Bangladesh and in the Narangwal study in India. Not only is treatment sought from inadequately qualified practitioners but it is also delayed longer than it is for males (Bhatia: 1983).

In a study of child mortality in rural Punjab it was found that the treatment, when it was sought was delayed for more than 24 hours for 44 pecent of the female children as compared to 23 percent of the male children (Kielmann, 1983; Majumdar : 1994).

In one study Gulati (1987) found out that intensity of desire for additional child turns out to be higher among

mothers with predominance of daughters among surviving children. This clearly reflects the prevalence of son preference among mothers in the Indian society. People with the higher income groups are less liable to desire additional children which could be possible because of greater economic security average desirable member of sons is found to be higher than average desirable member of daughters. However, all daughters are not discriminated against since in most traditional Indian families, a single daughter is highly valued. So selective discrimination occurs against daughters with older sisters (Das Gupta: 1987).

One form of extreme discrimination against the girl child is female infanticide. The most recent furore was caused by the discovery of female infanticide cases in Salem district of Tamil Nadu where 44 percnet of 1000 women surveyed admitted to female infanticide while 38 percent said that if they had more than one female child they would have no other option (Shetty: 1993; Majumdar 1994).

As Abel (1988) reports that female infanticide is practiced in the RUHSA (Rural Unit for Health and Social Affairs) area of K.V. Kuppam block in North Arcot district of Tamil Nadu.

Female infanticide has been found to continue in other parts of the country even today. Lately female infanticide is being replaced by female foeticide (Sachar et al.: 1990, Miller: 1981; Majumdar 1994).

Dreze and Sen (1995) argued that the deliberate neglect of female children ought to come under the label of infanticide. The social practices that lead to excess female mortality are far more subtle and widespread than the graphic stories of infant drowning, poisoning or asphyxiation that periodically make headlines in the newspapers. This is not to deny that female infanticide, strictly defined, does indeed occur in India today and has done so in the past.

A well documented practice of preferential treatment of boys and neglect of female children in intra-household allocation is a direct evidence of neglect of female children in terms of health care, nutrition and related needs, particularly in north India (Dreze and Sen: 1995).

Miller (1981) has compared the patterns of child care in north and south India. Studies from the north have indicated that there is joy and celebration at the birth of a son but not when a daughter is born. Boys in the north tend to get better food and better medical care than girls. In the south, any such preference is observed mainly at the

time of menstrual seclusion when it is the girls who receive better food. Preference for sons is rather moderate in the south while it is intense in the north. It is possible that there is a gender bias in the utilization of health services for both preventive (immunization) and curative care (Abel : 1988). An interesting study needs to be mentioned here. Gittlusohn (1991) while studying intra-household food allocation in rural Nepal observed that there is no difference in allocation of food between a girl child and a boy child (Majumdar : 1994).

Studies have shown that among children hospitalised for protein calorie malnurition (Kwashorker), boys outnumbered girls by between 47.53 to 1, but field nuritional studies show that Kwashiorkor is 4-5 times more common among girls. Similar observation has been made in Bangladesh, where the incidence levels of field diarrheas were comparable between male and female children. Among those brought to the treatment facility male children exceeded female children by 66 percent (Bhatia: 1983).

The sex bias is reflected in (i) the greater prevalence of undernourishment of various degrees among girls than boys, and (i) in the lower growth dynamics of girls.vis-a-vis boys (Sen and Sengupta: 1983). Between the two village of study Sahajapur and Kuchli, the village with the better

(Kuchli) overall nuritional record has much sharper sex discrimination. The economic benefits accring to the children of Kuchli through land reform etc. seem to have primarily benefited boys vis-a-vis girls (Sen and Sengupta: 1983).

A recent study by Murthy, Guio and Dreze (1995) discussed that the variables directly relating to women's agency (in particular, the female work participation rate and female literacy) have strong effects on the extent of female disadvantage in child survival and go in the expected direction, i.e., higher level of female literacy and work participation are associated with lower levels of female disadvantage in child survival.

Mean Age at Marriage

One of the mortality relationship that has been observed in both developed and developing countries is that relating the level of infant mortality to the age of mother. The relationship is expected to be a U shaped curve, where the minimum rates will pertain to infants born to mothers 20 to 30 years old (Arriaga and Hobbs: 1982).

In India the practice of marrying daughters at an early age contributes significantly both to maternal and infant mortality. Early marriage leads to early child bearing causing complications like cophalopelvic disproportion resulting in prolonged or obstructed labour, ruptured or

prolapsed uterus infection, hemorrhage and in some cases even death (Khan: 1993). He found that the health of infant is affected by the age of mother when they are born (Khan: 1993). Infant mortality rate is less common among women between the ages of 20 - 30 than among older or younger woman. While discussing about mean age at marriage Beenstock and Sturdy (1990) says that the relative probability of infants dying is 38 percent greater when mothers marry before the age of 18. Even Padmanabha (1982) agrees with this view and say that mean age at marriage has strong influence on infant mortality.

One study of Kanitkar and Murthy (1980) for rural Rajasthan show the effect of maternal age on neonatal and post-neonatal mortality rates. The relationship is sharper for neonatal mortality. So maternal age is clearly of great importance and from the perspective of lowering the risk of infant mortality, it is beneficial to have children between the ages of 20 to 29, and avoid child bearing in the early times (1988).

Gandotra and Das in their study in Gujarat showed the importance of demographic and socio-economic factors on infant mortality in which they found that infant born to mothers below 20 and above 35 have relatively high infant mortality compared to babies of women aged 20 - 34 (1988).

Female Literacy Rate

The degree and persistence of illiteracy reflect structural imbalance in any society, in particular the uneven distribution of political and economic policies and priorities are determined. So literacy is a measurement of progress (UNICEF: 1990). It is believed to influence behaviour. It gives women the power and the confidence to take decision making into their own hands (Ware: 1984).

Education of women greatly changes the traditional balance of familial relationship 'with profound effects on child care' (Caldwell: 1979 Ware : 1984). He also observed that "those without schooling no longer expect the same adherence to traditional roles from the educated that they do from the illiterate. A women with schooling is better able to judge the rationality of certain behaviour and is..... more likely to challenge her mother-in-law and the mother-in-law is much less likely to fight the challenger." The education of women can be expected to change both the work pattern and opportunities for women and at the same time make them less dependent on men (Ware : 1984). Palloni (1981; UN : 1985) in his study in Latin America has shown that literacy has a much greater influence on child mortality than infant mortality.

Bhuiya and Streatifield (1992) found that maternal education improves child survival. From neighbouring Nepal and Bangladesh they found that mothers with some years of schooling had significant lower mortality in comparison to those born to uneducated mothers.

In another study of the same authors in Bangladesh it is discussed that the odds of dying of children of uneducated women was 1.86 times higher than those of secondary educated women; in the case of primary educated women, the odds was about 1.4 times higher. It is presumed that educated mothers are able to take better care of their children, as they are more knowledgeable of health, hygiene, disease causation, and the environment. Educated mothers react faster to illness and utilize health services which leads to earlier treatment. Education tends to reduce gender based treatment and the gap between survival chances between boys and girls narrows. The Bangladesh study reports that for mothers who had at least five years of schooling, the mortality risks of girls and boys converged (Bhuiya and Streatfield: 1991, 1992).

D'souza, Bhuiya and Rahman (1982) while doing study in Mattab in Bangladesh arrived at the conclusion that there is a inverse relationship between education of mother and mortality rates. In the age group 1 to 3 years the

mortality rates are over five times as high for children of mothers with no education as compared to those having far more years of schooling.

In the same area Rehman and D'Souza (1982) found the same conclusion that there is a positive effect of mother's education on survival between the ages of 6 to 35 months, when the effects of other variables are held constant. The different impact of mother's education on survival of children of different six indicates how deep rooted sex discrimination is in this community. According to D'Souza (1986) Immunization of children is positively correlated with mother's education and an educated herself is responsible for delay treatment of ill girl child. But she cannot be blamed because it shows an attitude developed and nurtured by culture in which social status and economic value of the girl child are not equal to those of the boys.

So female literacy is unambiguously found to have a negative and statistically significant impact on under-five mortality, even after controlling for male literacy. This is consistent with growing evidence of a close relationship between female literacy and child survival n many countries, including India. Further the authors find that female literacy has a larger effect on female under-five mortality than on male under-five mortality; this is why the ratio of

female to male mortality is lower at higher level of female literacy, even though mortality rates fall for both male and female children as female literacy increases (Dreze and Sen: 1995).

Beenstock and Sturdy (1990) in their study found that the relative probability in infants dying in the case of literate women is 44 percent smaller than for illiterate mothers. So illiteracy of mothers is a contributory factor to infant mortality. Das Gupta (1990) says that the mother tend to be the primary careor for children. The inner abilities to care the child is similar in everybody but literacy acts exogenously to improve those abilities, e.g. in Kerala where literacy rate is higher infant mortality rate is 29 per thousand live birth and Punjab, where literacy rate is lower but economic condition better , has infant mortality 55 per thousand live birth. With the literacy reproduction appears to be highly targeted towards an ideal number of surviving children.

Bourne and Walker (1991) in their analysis strongly suggest that a mother's education has an even greater effect on the survival of her daughters than it does on that of her sons. The average education effect for northern boys by age 5 reduces death by 77.44 per 1000; for northern girls, the average education effect reduces deaths by 95.87 per 1000, a

difference of 18.3 death per thousand or almost two percent. Education also gives women the potential to improve their own lives and health.

Jain (1985) in his study say that the level of women's education was particularly important for the level and trends in infant and child mortality. At the all India level, the infant mortality rate in rural areas decreases with an increase in the level of women's education from 145 per thousand births among mothers with no education to 101 among mothers with some education and 71 among mothers with at least primary education. In his study, he proves that there is a basic inverse relationship between infant mortality and women's education for each state (except Assam and Andhra) in rural India. Murthy, Guio and Dreze (1995) after the analysis established that female literacy has a negative effect on both male and female child mortality, but the effect on female child mortality is larger.

1.5.3 **Infrastructural Factors**

This includes good sanitation, electricity availability of safe drinking water and health services. All these have very direct impact on mortality. Our literature review is basically concentrated on safe drinking water facilities and health services.

Safe Drinking Water

Just as safe water can give life and protect health, polluted water can ruin it. So safe drinking water supply has become a key public health factor in the third world where a large proportion of all diseases are considered to be water related (Banerji : 1985).

Feachman (1981) points out that, of all the infectious diseases diarrhoeal diseases are of the greatest importance, which are caused by polluted water supply. Rowland (1979) argues that the transmission of infectious diseases in Africa through a polluted water supply contributes to the contamination of traditional wearring foods (U.N.:1985).

It is discussed in the World Health Forum (1994) that drinking water is vital in disease prevention and reduction of mortality.

A study done by Beenstock and Sturdy (1990) about infant mortality in India found out that with the increase in every 1 percent safe drinking water in population the relative probability of infants dying falls by 3 percent. In a comparative study they showed that the relative probability of infant dying for mothers drinking unclean water was 11 percent higher than for mothers who drink tap water (1990).

Nag (1983) while discussing about the mortality pattern of Kerala and West Bengal, mentioned that Kerala provides much of its population with reasonably clean water for drinking. The availability of clean water is an effective check up on epidemics. West Bengal has more water tanks, but due to lack of proper maintenance, the water in these tanks is not hygienic.

Khan (1988) in his study on infant mortality in U.P. emphasized on safe drinking water. Post neo-natal mortality seems to decline substantially with a shift from well (173) to pipe water (73). Even Padmanabha agrees with this view. Differential in infant mortality can be seen with different source of drinking water. Infant mortality in rural areas with tap water was 103 while in areas with pond/tank/and river water it was 137 per thousand live birth. In urban areas it was 63 with tap drinking water and 93 in pond/tank/and river (1985).

Health Infrastructure

It is not unreasonable to accept survivalship to be linked to the availability of health care services. Access to modern medical facilities throughout a mother's pregnancy, at delivery and during infancy and childhood is thought to be particularly important in reducing mortality. Governments in developing countries often assume that the

optimal route to lower mortality is through expansion of the formal health sector and are further encouraged along these lines by the benefits that accrue to builders and occupants of modern highly visible health facilities (Mosley: 1983 UN : 1985).

Sometime it is argued that it is wasteful to put large inputs into health services without putting equivalent inputs into education especially that of girls (Caldwell and McDonald: 1981; UN 1985). According to Yunes, Chelala and Blaistein economic development doesn't necessarily bring improvement in health Sector (1994).

One of the tasks of reducing social and economic inequalities in India involves the expansion of social security provisions, broadly understood as social arrangements to protect all members of society from extreme deprivation and insecurity. Among the different forms of interventions that can contribute to the provision of social security, the role of health care deserves forceful emphasis (Dreze and Sen: 1995).

In India actual treatment of diseases is an interaction of five factors viz. (i) need, (i) perceived need, (ii) availability, (iv) ability, and (v) permission (World Bank: 1991; Majumdar : 1994).

This is the one field where there is an overwhelming need for bold initiative and comprehensive reform. Compared with many other developing countries, India has poor health achievement despite spending a comparative large part of its GNP on health (Dreze and Sen: 1995). Our health infrastructure effectively reaches only 20 percent of the population (Gopalan C.: 1985).

A study (Bhatia, Mathur, Hand, Dubey and Trivedi: 1984) was done in Sevagram, village of Wardha district about the high peri-natal loss. The reason had found was that the hospital which were located in rural areas are very far and complicated cases reach very late because of poor transport facilities. The lack of advanced intensive care and investigation facilities were also the contributory factors. Half of the mothers never utilised the facilities of anti-natal services even once inspite of the fact that this hospital is itself located in a rural area. There is also the problem of non-availability of round the clock running water supply in rural set up.

Banek and Saha (1975) while doing study about urban community found that high peri-natal mortality about 20 percent was found in babies delivered to mothers having irregular anti-natal care. Most of the mothers included in this group belonged to the poor socio-economic segment of

the community. Lack of proper anti-natal care, inadequate food and recurrent infections in malnurition and anaemia in the mother.

Arora (1980) while discussing the levels and trends in infant, neo-natal and post-monatal mortality in greater Bombay, mentioned that post-natal mortality has declined much faster than neo-natal mortality which is indicative of improved infection control. One way to reduce such infant death is to identify high risk pregnancies particularly earlier and later provide necessary health and medical facilities at the right time before it gets too late.

Several factors in the mother affect the neo-natal directly or indirectly. The study shows the effects of obstetric complication on the new borns.

The neo-natal mortality is adversely affected by toxemia of pregnancy leading to a high incidence of low birth weight and pre-term babies, high mortality, pre-maturity leading to high peri-natal loss. It is obvious that many factors which affect the newborn adversely can be prevented and if treated adequately in time, may improve the outcome of the facts and reduce the peri-natal loss (Sharma, Idnani and Saxena: 1978)

Ghose (1989) in her study mention that the availability of health services is not satisfactory, its utilization is

less than 20 percent and even less by women. In an aggregate level of analysis of differential utilization of health care facilities in two Indian states, Kerala and West Bengal, Nag (1983) argues that education promotes awareness and use of public services. Despite per capita income and greater urbanisation and industrialization, West Bengal has marketedly lower levels of literacy, particularly among women. Although direct evidence is not provided, the claim that the traditional emphasis on education in Kerala has contributed to greater health care utilization and lower Infant and child mortality is not unreasonable. the rural poor in Kerala are more aware of their rights to use health and other public facilities than those in West Bengal.

Orissa suffers from the highest infant mortality rate that is 115 per thousand live birth in 1993. It is due to low birth weight and malnurition. All the health programmes are futile due to the apathetic attitude of medical officials 60 percent of vacancies are either reaction causing or impotent. While the all India expenditure on health per person was 85 Rs. The Orissa government spent only Rs. 74. Health care service has allocated only 7 percent of funds in 1995-96 in which 5 Percent of the allocation goes in the form of employees Salary (Hindustan Times : 1995)

Health Intervention programmes definitely change the scene. One study done by Abel (1988) in RUHSA (Rural unit for health social Affair) area of K.V. Kuppam block in North Arcot district. The early and late neonatal mortality started declining earlier than post-neonatal mortality which is different from the pattern generally observed. The observed pattern is due to the effectiveness of intervention during the anti-natal and natal periods.

Kumar and Dutta (1988) have done their study in selected rural area of Ambala district, which had 8 PHC and 150 sub centres. In those area Dai training programmes have been in operation since 1978 and IDCS was also introduced in two blocks. The selected areas had initially very high infant mortality rate. After these health intervention pogrammes the decline in Infant mortality was fast. The striking differences between the infant mortality rates in intervention and non-intervention areas show the importance and effectiveness of specific interventions. Due to a neonatal tetanus and acute diarrnoea diseases, which account for a major share of IMR, by the introduction of specific interventions reduce drastically. Rao and Coyaji (1988) have done a study of Vadu rural health project in Maharashtra where infant mortality rate was exceptionally high. The observed decline of infant mortality has been

faster than the average for rural Maharastra. The infant mortality in rural Maharastra declined by 8.3 Percent during 1978-82 in comparison to 36.5 Percent in the vadu rural health project.

Although there have been various public health programmes, there was an alarming sign of neglect and deterioration in the basic framework of public health. One of these signs is the massive displacement of health care activities by family planning programs (Dreze and Sen: 1995)

1.5 **Hypotheses**

1. Life expectancy at birth is directly related with female literacy.
2. Infant mortality rate and child death rate are inversely related with female literacy.
3. Female work participation is directly related with life expectancy and inversely related with infant mortality rate and child death rate.
4. Poverty is directly related with infant mortality rate and child death rate and inversely related with life expectancy.
5. Mean age at marriage is directly related with life expectancy and inversely with infant mortality rate and child death rate.

6. Safe drinking water is positively related with life expectancy and negatively with infant mortality rate and child death rate.

7. Health service that is hospital bed and population ratio is negatively related with infant mortality rate child death rate and positively with life expectancy.

1.6 **Data Base:** The present study is entirely based on secondary sources. In view of the objectives and hypothesis of this study, the data for different variables are drawn from the following sources:

1. Census of India 1991, final Population Tables, Paper 2 of 1992 and other volumes.

2. Census of India 1971, social and cultural table series I, part II C (ii).

3. Health statistics of India 1976 and 1982 Vol. Bureau of Health services.

4. Handbook of Housing statistics 1980.

5. Mathur A, "some reflections on the regional Dimensions of Economic Development in India 1992. A lecture delivered at the Lalit Narayan Mishra Institute of Economic Development and social change.

6. Pannapalli, K.M., Parasuraman's S R S based abridged life table 1986-96 (using schoen (1978) method) series IIPS research Report.

7. Sarvekshana, Vol. XVI and XVII No. 1 and No. 4 55th and 56th. April-June and July-September. (July 1986-June 1987).

8. Sample Registration systems of 1969-70, 1976, 1980, 1985, 1990 and 1992.

9. Year Book Family Planning Welfare Programme in India 1975-76, 1979-80 and 1986-87. Ministry of health and Family welfare.

1.7 Selection of Variables:

There are several mortality measures based on death statistics. They vary in the aspect of mortality they describe, their degree of refinement or elaboration, whether they are summary measures or specific measures and whether they are measures of mortality or merely mortality related measures.

expectation of life at birth:

It gives a measure of the cumulative effect of mortality over the remaining life-span after the attainment of the ages x. It is denoted by e: in the life table. It also helps us to show the quality of life.

Infant mortality Rate and Child Death Rate:

It is one of the sensitive indicators of mortality. It shows the socio-economic condition and health progress which prevails in that society. Infant mortality rate is the

number of deaths of Children under one year of age occurring in the same year.

Child deathrate is the number of deaths of children from birth to age 4 in per thousand live birth. In India child death rate shares 47 Percent of total deaths, that is almost of the total deaths, So, it becomes necessary to emphasis on child death rate while discussing mortality pattern in India.

Infant mortality shares 30 Percent of all deaths, so not only child death rate but also Infant mortality rate has to be studied separately to know the nature of mortality pattern.

To explain these dependent variables some explanatory variables have been selected:

(1) Economic Variables

(a) Percent population below poverty line

(b) Female work participation

(2) Socio-Cultural Variables

(c) Female literacy

(d) Mean age at marriage

(3) Infrastructural Variables

(e) availability of safe drinking water

(f) Health service: Hospital bed and population ratio

(A) **Percent Population below poverty line:** India is economically very backward . Here poverty is very deep rooted and it affects every way of our life. So we look at poverty as one of our explanatory variables, so with that we try to explain upto what limit, it is explaining variation in our dependent variables.

Number of persons below poverty line on per 100 of population is called Percentage of population below poverty line.

(B) **Female Work Participation Rate:** It is said that female work participation improves the relative survivalship, especially that of children through increase in income. But it is difficult to predict whether the effect of female work participation is positive or negative. There are two important effects: (1) Involvement in gainful employment has many positive effects. (2) Secondly, 'the double burden' of household and outside work can impair women's ability to ensure good health of their children. So in the analysis it would be seen whether it has any positive or negative effect.

Female work participation rate is the number of female main worker per hundred population of female sex

(C) **Female literacy rate:** Female literacy is found to have a negative and statistically significant impact on child

mortality as also on life expectancy at birth literacy given her power to determine the family size. It makes her more aware about family health. She gets more exposure to the world. There is a large effect of female literacy on female under five mortality. So the effect of female literacy is quite large for greater than overall literacy and male literacy.

Female literacy rate is the number of female literate per hundred population of female excluding the age group 0-4 in 1971 and age group 0-6 in 1991.

(D) **Mean Age at Marriage:** In India mean age at marriage is very low. This early marriage contributes significantly both to maternal mortality and infant mortality. It is obvious that the health of infants is greatly affected by their mother's age when they are born. So in explaining the factors responsible for mortality mean age at marriage may be one of the explanatory variables.

Mean age at marriage is a measure of the mean age at first marriage derived from a set of proportions of people single at different ages or in different age groups, usually calculated separately for males and females.

(E) **Availability of safe drinking water:** Infrastructural factors like Electricity, sanitation and safe drinking water affect human survival ship. It is one of the very important

variable which affect the mortality. It helps to prevent diseases, which is one of the major reason for children's death. The literature survey provides us enough evidence that with availability of safe drinking water child deaths can be reduced. In a way, it affects on life expectancy also.

The number of sources of safe drinking water available on 100 household.

(F) **Hospital bed and population ratio:** It affects directly the health status of the society or a population. The ratio of availability of hospital bed on population show whether the proportion is appropriate for the survival of that population. If the ratio is high, it means the area is well equipped with preventive and curative measures or vice-versa.

$$\text{Hospital bed and population ratio} = \frac{\text{No. of hospital of that state}}{\text{Total population of that State}} \times 10{,}000$$

1.8 **Methodology**:

Processing of data using quantitative methods for the better understanding of a phenomena -- is an important part of research. To quote Prof. Mooniz Raza, ".... one has to select quantitative indicators of quality in order to make qualitative assessments." (Mahmood: 1977) Thus, in order to

make qualitative assessment possible, the use of statistical tools becomes necessary. For this study following techniques have been used.

a) **Percentage change in infant mortality** - In order to show the percentage change during the decades.

$$\frac{b - a}{a} \times 100$$

Where a = infant mortality rate of 1970
b = infant mortality rate of 1980

b) **Index of relative change** - It is used to show the relative changes between two variables.

$$x - y = x^1$$

$$\frac{x^1}{x} \times 100$$

where x = probability of dying n (qx) of 1970-75 for different age group.

y = probability of dying n (qx) of 1986-900 for different age group.

x^1 = difference of n (qx)) of 1970-75 to n (qx) 1986-90 of different age group.

c) **Stepwise Regression** - The stepwise regression analysis is applied to understood the rate of explanatory variables and the dependent variables. The variables are given under:

(i) Dependent variables:

y_1 = Expectation of life at birth
y_2 = Infant mortality rate
y_3 = Child mortality rate

(ii) Independent variables:

x_1	=	Female literacy
x_2	=	Female work participation
x_3	=	Percentage of population below poverty line
x_4 & x_7	=	Safe drinking water
x_5	=	Mean age at marriage
x_6	=	Hospital bed and population ratio
x_8	=	Source of water other than Tap/Tubewell/well

Cartographic methods: Bar diagrams and graphical methods have been used to depict the statistical information

1.9 Limitation of Data

Our study is based on secondary data that is one of the most important limitation.

The study show the comparison between two time period, like 1970 and 1990. Through the analysis, it has to determine, which explanatory variable explains them most. But for both period, although common explanatory variables are there, there is little changes in few variables. Like for the period 1970, female mean age at marriage has been taken and for 1990, it has been taken for the total person because of unavailability of data separately for female.

The concept of safe drinking water had not been introduced in 1970, so we take tap, tubewell and well water as safe drinking water. Sources other than this are not called safe drinking water. This data has been taken from

the NSS. For 1990, census data has been available for safe drinking water.

Data for the percent population below poverty line has not been available for the exact year 1970 and 1990. so for the period 1970, the data of 1972-73 and for 1990, the data of 1987-88 has been taken into account. For the other explanatory variables (like female literacy) the data of 1971 census and 1991 census has been taken into consideration.

Our dependent variable infant mortality rate and child death rate have been taken from sample Registration System. Even this system is subject to three types of error (i) sample error, (ii) non-sampling error, (iii) matching error (Padmanabha : 1984).

1.10 **Scheme of Chapterisation**:

The present study has been divided into five chapters.

The first chapter deals with general introduction, objective of the study, hypothesis, literature, review, database and methodology etc.

The second chapter discusses the spatio temporal pattern of life expectancy.

The trend of life expectancy, its rural urban comparison and sex differential.

The third chapter deals with infant and child mortality and its spatio temporal pattern. How the trend and pattern varies between rural-urban sector and between male-female.

Fourth chapter discuss the factors affecting the mortality pattern and its analysis and results.

And fifth chapter gives the summary and conclusion.

CHAPTER - II

SPATIO - TEMPORAL PATTERN OF LIFE EXPECTANCY AT BIRTH

2.1 Introduction

The expectation of life is one of the best indicators which reflects mortality by age. It gives a measure of the cumulative effect of mortality over the remaining life after the attainment of age x. Here an attempt has been made to study the trend of mortality with the help of expectation of life at birth. There will also be a brief discussion about how it differs in rural and urban areas and also between males and females.

2.2 Time Trend of Mortality in India

Before 1921, India had a high level of mortality with crude death rate over 40 per thousand. This period is marked by a purely agrarian economy with hardly any significant industrilization. A severe famine affected large areas of the country in 1896 and 1897. In the Bombay Presidency (excluding the princely states), especially, the effects of the famine were aggravated by a severe plague. Like the 1891-1901 decade, the next decade also witnessed several local famines and a severe one in 1907 in most part of U.P. Plague was in evidence in the Bengal and Bombay Presidencies and both plague and malaria were widespread in the Punjab and U.P. During the 1911-20 decade India suffered from an influenza epidemic that caused an estimated 7 per cent of the total population to die (Premi : 1991).

As the table 1.2 shows there is increase in death rate during 1911-1921. After that it started declining gradually. The decline is sharper in 1951-1961 with crude death rate 22.8 per thousand. During 1981-91 it reaches 10 per thousand.

The decline in mortality is reflected in the rise in the expectation of life at birth in successive decade

Table 2.1 : Life Expectancy at Birth in India

Periods	Years
1901-11	22.9
1911-21	20.1
1921-31	26.8
1931-41	31.8
1941-51	32.1
1951-61	41.2
1961-71	47.7
1970-75	49.7
1976-80	52.3
1981-85	55.5
1986-90	57.9

as the table 2.1 shows the life expectancy was very low in 1901-11. It shows that there is a substantial increase in life expectancy. The increase is more prominent after 1941-51 decade, when from 32.1 years, it became 41.2 years. This trend synchronized with the wide use of new insecticides and drugs for various communicable diseases in India. The trend of increase show that life expectancy in India is now 57.4 years. Although the increase is impressive, it is very low

PROBABILITY OF DYING AT DIFFERENT AGES
IN 1970-75 AND 1986-90 IN INDIA

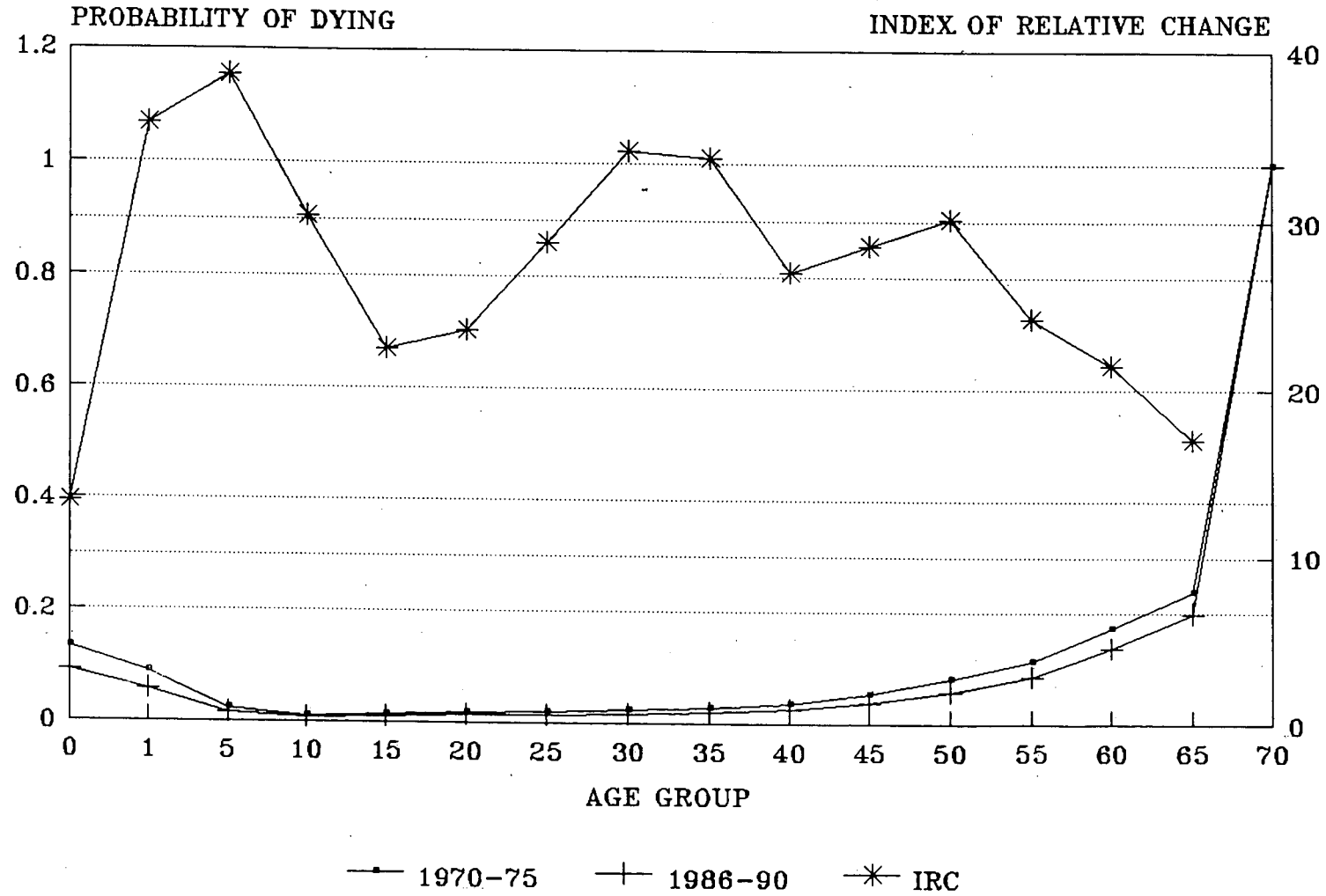


FIG: 2.1

compared uts other Asia countries and the world. This we have already discussed in Chapter I.

2.3 Mortality Rate of India in Different Age Grop From Life Tables nqx values

nqx is the probability of dying between age x and x+n. It represents the proportion of those who die during the interval to the members alive at the beginning of the interval. The given graph 2.1 shows the mortality rate in India for 1970-75 and 1986-90 years. The index of relative change helps us to know the relative difference prominently between the two period of time.

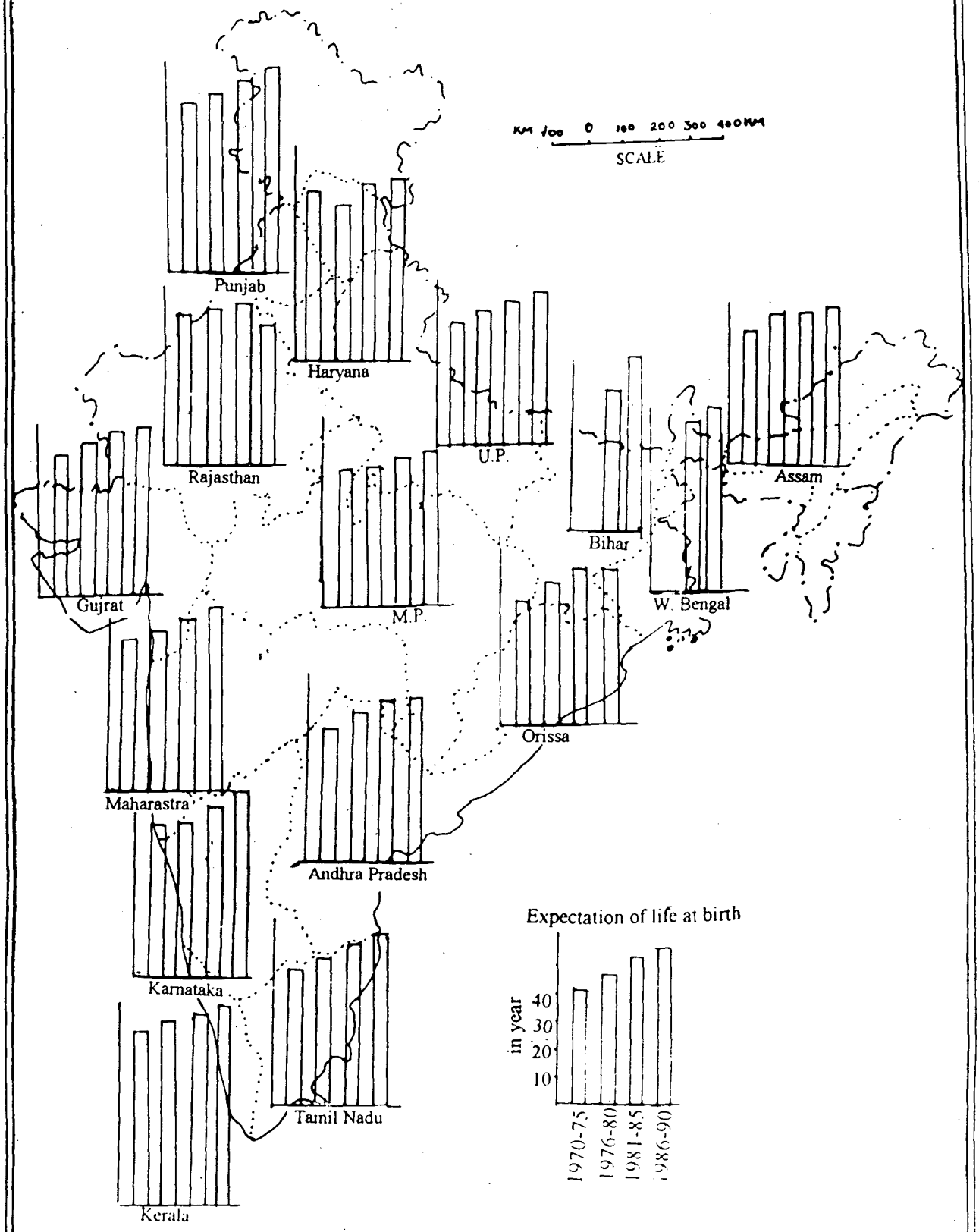
In the life table mortality death rate at age one is more than .1, which is very high. Just after 0-1 age, mortality starts declining. Mortality is minimum at the age of 10 to 20 years. After this period, again mortality starts increasing, which continues till death. Although the line graph of both periods doesnot show differences very clearly, it is obvious that mortality rate that was high in 1970-75 declined substantially especially in age group 0-1 and 1-5. The difference is minute between age 15-20. More difference is visible after the age of 40. The Index of relative change shows these changes very clearly. It clearly shows that the difference is very sharp in age group 0-1 followed

MAP NO. 2.1

INDIA

EXPECTATION OF LIFE AT BIRTH

(1970-75, 76-80, 81-85, 86-90)



NO DATA AVAILABLE FOR BIHAR AND WEST BENGAL FOR THE PERIOD 1970-75, 1976-80

by 5-10 age group. The minimum difference is visible in the age group 15-20.

2.4 Interstate Variation in the Life Expectancy Since the Beginning of 1970

During 1970-75 Kerala had the highest life expectancy at 65.5 years and U.P. had the lowest of 43 years. The gap between highest and the lowest life expectancy was 19 years. This gap hardly declined in 1980. In 1986-90 the gap is 17 years, so in the last fifteen years, the decline is first of two years, in the highest and lowest life expectancy.

The overall observation shows the general increase in life expectancy but the increase varies not only from state to state but also differs from East to West and north to south.

The observation (map 2.1) shows that life expectancy is higher in south India than in north India. Most of the states of south India during 1970-75 had life expectancy around 60 years. Maharastra, Tamil Nadu, Karnataka and Andhra Pradesh had life expectancy around 60 years. .Kerala with its outstanding picture shows 62 years in life expectancy. Bihar, U.P., Madhya Pradesh, Gujarat and Assam had low life expectancy. After fifteen years in 1986-90, Kerala added eight years in its life expectancy while Tamil Nadu, Maharastra, Karnataka and Andhra Pradesh, 10, 10, 6 and 11

years respectively. Now in 1986-90 all of the southern states are showing more than 60 years of life expectancy. In north India only Punjab and Haryana show high life expectancy, which was also high in 1970-75.

Table 2.2 : Statewise Life Expectancy for the Period 1970-75 and 1986-90.

States	1970-75 in years	1986-90 in years
Andhra Pradesh	48.8	59.8
Assam	45.5	53.8
Bihar	---	55.1
Gujarat	48.8	58.2
Haryana	57.5	61.7
Karnataka	55.2	62
Kerala	62	70
Maharastra	53.8	63.3
M.P.	47.2	53.5
Orissa	45.7	54.2
Punjab	57.9	64.6
Rajasthan	48.4	55.9
Tamil Nadu	49.6	60.8
U.P.	43	53.2
W. Bengal	---	61

Both of these states improved by 76 and 4 years in last fifteen years. U.P. still suffers from lowest level of life expectancy at 53 years, inspite of 10 years increase in life expectancy from 1970-75 (see the Table 2.2). Although data is not available for Bihar and West Bengal for the period 1970-75, but the trend of 81-85 help us to know that even they had very low life expectancy. Orissa and Assam had very low life expectancy. Orissa and Assam had life expect-

ancy of not more than 54 years. The states of central India, like M.P. added six years in life expectancy, still it has not exceeded 60 years So is the case of Gujarat.

The states with the maximum increase in life years still have low or moderate level of life expectancy e.g. Orissa and U.P. with 54 and 53 years respectively.

Haryana is the only state where it declined in 1976-80. Its rural sector showed declining trend for both males and female. Except Punjab and Haryana the whole & of eastern, western, and northern part has low life expectancy compared to southern states. Kerala is the only state, which presents very outstanding picture, with the highest life expectancy both for male female and rural-urban.

The interstate variation in life expectancy cannot be explained by a single cause. These variations show socio-economic and demographic characteristics as well as historical, political and cultural diversities Kerala which enjoy the highest life expectancy is socially much developed than other states in India.

Education is an important factor which directly and indirectly affects the quality of life. Kerala has 89.8 per cent literacy rate. Most of the southern states enjoy around 50 percent of literacy rate e.g. Maharastra has 64.8 percent and Tamil Nadu, has 62.6 percent of literary rate.

The northern states suffer form low literacy less than 50 percent sometimes. e.g. Bihar had 38 percent, U.P. 40 percent and M.P. 44 percent of literacy rate in 1991.

Southern states are economically better off then these northern and Eastern states. So is the case of PUnjab and Haryana. Both of them are agriculturally much developed than the rest of the states.

Although the government has various plans to reduce the level of mortality, that is, increase in life expectancy, sometimes social and cultural setting facilitates them or slow down their pace. It also depends on adoption to changing life styles, development of physical and human resources, adoption and effective utilization of innovative technologies, including those affecting directly or indirectly the family formation and health.

At the same time the existence of health infrastructure is not the sole agent in this process. High level of literacy (which, among other aspects its complex impact on people's behaviour and life style also prompts awareness of ways of health, protection and a high utilization of services available), social welfare policy, development of adequate housing and water supply, environmental hygiene etc and the rapid rate of economic growth with its corollaries

wage structure and more equitable income distribution play a role (Ruzicka : 1982).

2.5 Rural Trend of Life Expectancy

The national level estimation do not reveal the whole picture of regional and rural-urban variation. Inequality with respect to mortality exists in all societies irrespective of whether the national level of mortality is high or low (Ruzicka : 1982).

One of the best documented sub-national differences in mortality is that between urban and rural areas. Rural India, like any developing country suffers from widespread poverty, illiteracy and inadequate distribution of the health infrastructure. Life expectancy in general is higher in urban areas than rural areas. The national level rural life expectancy was 48 years in 1970-75 and now in 1986-90 it is 56.5 years. The highest life expectancy is found in rural Kerala throughout the twenty years both for males and females. U.P. suffered from lowest level that is only 42 years during 1970-75 but now rural M.P. has lowest life expectancy that is just 51.8 years. It shows that there is large disparity among the states.

Table 2.3 : Statewise Life Expectancy in Rural India

States	1970-75	1986-90
Andhra Pradesh	47.3	58.8
Assam	44.9	58.8
Bihar	-	54.6
Gujarat	47.4	56.7
Haryana	56.4	60.7
Karnataka	52.6	60.9
Kerala	61.7	70.8
M.P.	45.7	51.8
Maharastra	51.9	61.6
Orissa	45.1	53.2
Punjab	57.1	63.5
Rajasthan	46.6	54.5
Tamil Nadu	46.2	59.8
U.P.	42	52.1
West Bengal	-	59.4
India	48	56.5

The table 2.3 shows clearly that most of the states had low life expectancy below than the national level. These states are Assam, Orissa, U.P., Rajashthan, M.P., Gujarat, Andhra Pradesh and Tamil Nadu, All of them had less than 48 years of life in 1970-75. Very few states like Punjab, Haryana, Karnataka and Maharastra enjoy moderate level that is from 48 years to 60 years. Kerala showed us the outstanding picture with life expectancy 61 years in 1970-75.

In the years of 1986-90, the rural life expectancy increases upto 56 years. The scene of northern and Eastern India have hardly changed They still have low levels of life expectancy, that is just 52 years. M.P., Orissa, U.P.

Rajasthan and Assam come in this category Gujarat, West Bengal, Andhra Pradesh and Tamil Nadu have life expectancy more than 56 years but less than 60 years In last fifteen years Gujrat, Andhra Pradesh and Tamil Nadu have been able to increase their life expectancy. Rural Punjab, Haryana, Maharastra, Karnataka and Kerala enjoy maximum life expectancy that is more than 60 years.

Kerala is a state with large unemployment and low per capita income and yet enjoying high life expectancy. It is because its level of education, particularly of females and of rural areas is the highest one. Its health and sanitation services are one of the best. A number of Simple policy interventions dramatically bring down mortality. The principle proximate variable responsible for Kerala's Low level mortality seems to be the states leading position in the accessibility of its rural people to health facilities and their more effective utilization (Ghosh : 1991)

Health facilities and their utilization in rural Punjab are better than the Indian average. Another proximate variable that contributes significantly towards high level of life expectancy is the high nutritional intake of its people (Ghosh : 1991)

Health facilities and utilization of health services is very bad in BIMARU states and they have low level of litera-

cy also. Like, U.P., Bihar, M.P. and Rajasthan have 36, 33, 35 and 30 percent of rural literacy level. All these states have very low mean age at marriage, hardly 16 years. Not only these states are socio-economically backward but they have very strong traditional bond and gender bias.

2.6 Urban Trend of Life Expectancy

Life expectancy in Urban areas is always higher than national average because of the concentration of health services in these areas. This reason is partly good and valid. Urban population represent a better educated class unless it is balanced by proportionately high representation of slum dwellers with high risk of mortality.

Here my study is related with the change of urban trend in life expectancy for the period 1970-75 to 1986-90. As the table 2.4 shows, very few states like Assam, Orissa, U.P. and Gujarat had levels of life expectancy lower than 56 years. U.P. had the lowest level only 51 years both for males and females. The states which enjoyed moderate level during 1970-75 were M.P., Maharashtra, Andhra Pradesh and Tamil Nadu with 56 to 60 year of life expectancy. Kerala, Maharastra, Punjab and Haryana had the highest

Table 2.4 : Statewise Life expectancy in Urban India

	1970-75	1986-90
Andhra Pradesh	57.2	63.6
Assam	55.7	61.2
Bihar	-	62
Gujarat	55	61.5
Haryana	67.4	65.5
Karnataka	64.2	65.7
Kerala	63.2	69.8
M.P.	56.6	60.7
Maharastra	58.8	66.7
Orissa	55.4	62.2
Punjab	61.1	67.2
Rajasthan	59.6	63.2
Tamil Nadu	59.7	65
U.P.	51.5	66
W. Bengal	-	66
India	58.9	63.8

level that was more than 60 years of living. So, for the 1970-75 period, the picture emerges that most of the Indian states for urban sector had life expectancy more than 56 but below 60 years.

In 1986-90, there are changes in the scenario. The national average of urban life expectancy becomes 63 years. Bihar, M.P., Orissa, Gujarat and Assam have life expectancy below the national average. Rajasthan, U.P. Andhra, Karnataka, Tamil Nadu and West Bengal have life expectancy 63 to 66 year while Kerala, Maharashtra and Punjab enjoy the highest level of life expectancy that is more than 66 years of living.

STATEWISE RURAL URBAN LIFE EXPECTANCY AT BIRTH FOR THE PERIOD 1970-75

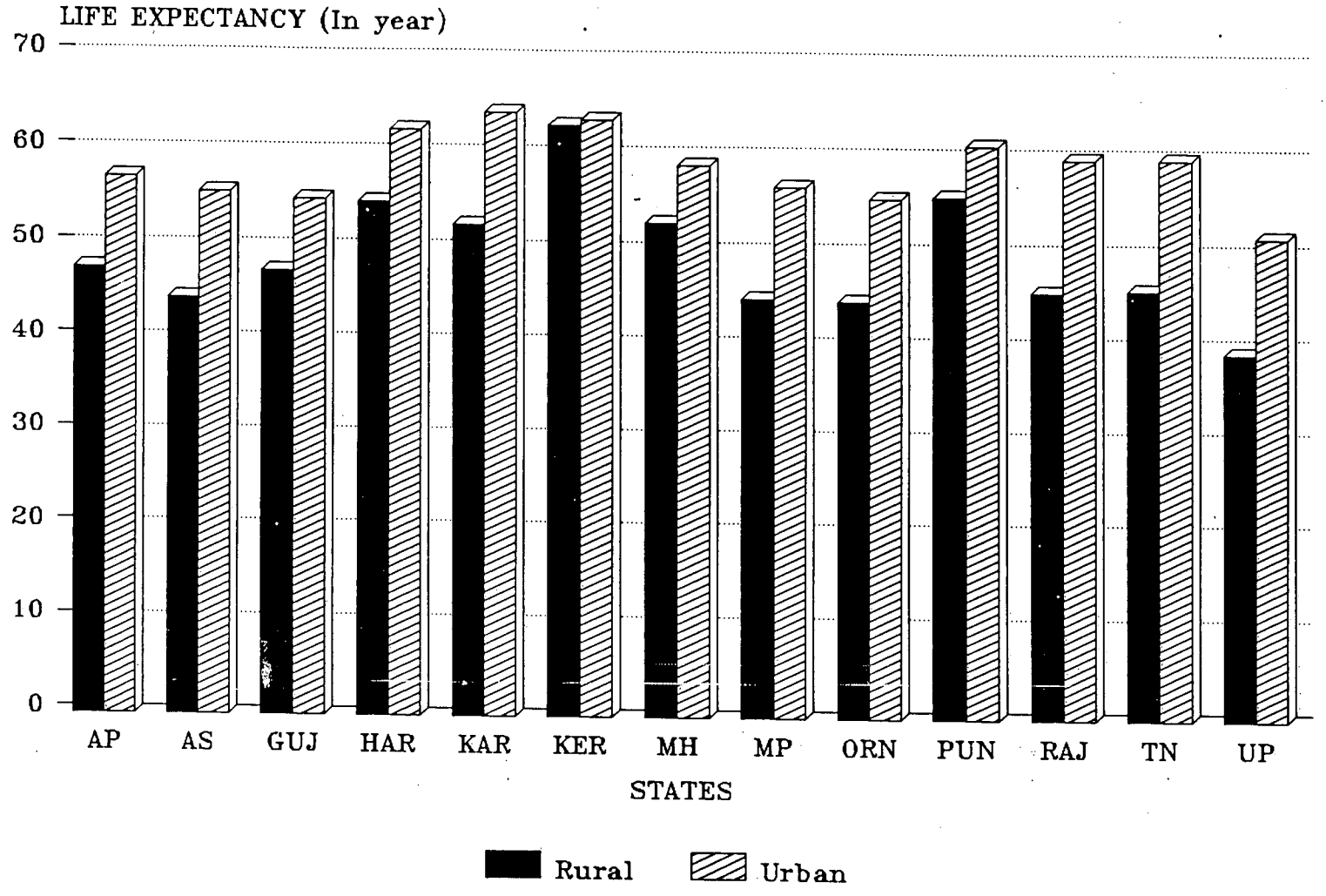


FIG:2.2

The lower level of life expectancy in M.P., U.P. and Eastern Indian states can be attributed to the lowest level of education with academic poverty (Ghosh: 1991). Many studies have brought out the poor functioning of health services in larger parts of India, especially the larger north Indian states (Murthy: 1995). The poor lacks the basic motive of certain living standard, good education, health care and better opportunities for self-advancement (Murthy: 1995).

The states which enjoy high level of life expectancy in urban area either they have better social development (e.g. Kerala) or economic development either in industrial sector (Maharashtra) or in agricultural sector (Punjab).

2.6.1 **Rural Urban Differential**

According to the Bar diagram 2.2 it is clear that rural urban differential exists in life expectancy. Rural life expectancy is lower in almost all the states. It was somewhere around 50 year and urban life expectancy was more than 55 years. The minimum rural urban differential was found in Kerala which was hardly 1.8 years followed by Punjab with four years. Maharashtra and Haryana had not much rural urban differential. It was hardly 6 years.

STATEWISE RURAL URBAN LIFE EXPECTANCY AT BIRTH FOR THE PERIOD 1986-90

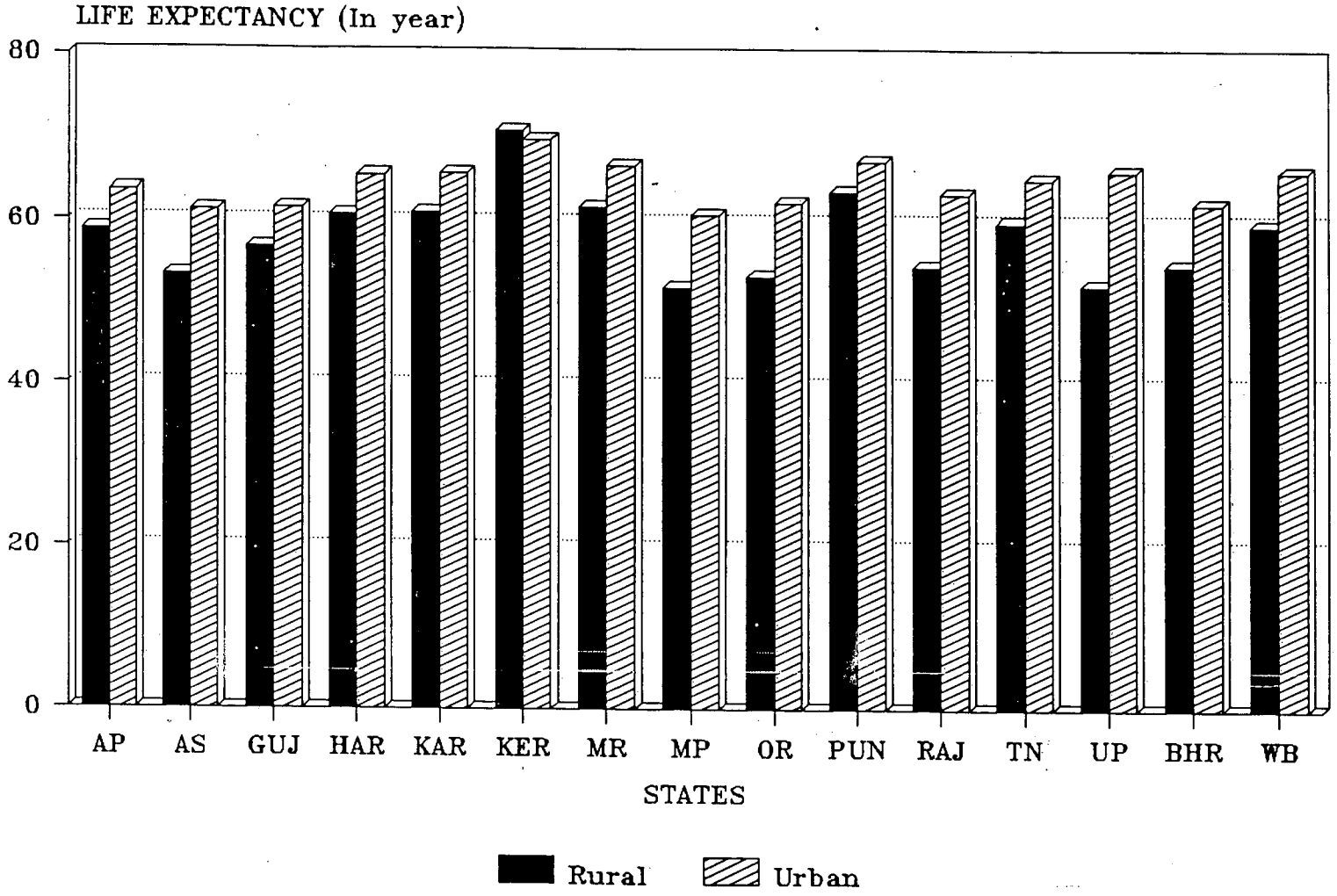


FIG:2.3

More than 10 years differential is found in Orissa. M.P., Assam, Karnataka and Andhra Pradesh. The maximum differences occur in Rajasthan and Tamil Nadu, that is more than 30 years.

The rural urban differential which was very prominent in 1970-75 reduced slowly in 1986-90. Almost in every state the gap declined except in U.P., where it increased from 9.5 years to 13.4 years. Kerala gives very different picture. During 1986-90, the urban life expectancy became lower than rural. (see fig 2.3). In rest of the states the rural urban differential varies from 3 to 8 years. In last fifteen years the gap between rural urban life expectancy has declined but is not sharp.

The rural urban differential is probably due to a combination of factors rather than to a single cause. These are four broad categories of circumstances that explain the situation (a) slow economic development curtailing the national government's expenditure on welfare programmes coupled with socially inequitable distribution of the benefits of development; (b) persistently high, if not increasing levels of poverty among the population in particular in rural areas; (c) slow social development with continuing high levels of adult illiteracy, low school enrollment and high drop-out rates (in particular among girls); widespread

chronic under nutrition (in particular among children); continuing low status of women, rural development lagging far behind urban (d) inadequate provision of heath services and their geographic distribution; dominant orientation of health care towards urban population, hospital based treatment oriented services, under utilization of available services for cultural and social reasons (Ruzicka : 1982).

During the last twenty years many government plans have been launched to increase the living standard and for decline in mortality.

National water supply and sanitation programme was launched in 1954. The main objective was to provide safe water supply and adequate sanitation arrangements for the entire urban and rural population of the country. Inspite of increased financial outlay during the successive five year plans, only a small dent has been made on the overall problem. According to a recent assessment made by the central public health and Environmental Engineering organization in 1990, only 30 percent of rural population have been provided with safe drinking water and only 2 percent have basic sanitation facilities. Out of 5.76 lakh villages, 2.31 lakh villages were identified as problem villages - i.e., where drinking water is not available within a distance of 1.6 kms or below the depth of 15 metres or where available source is unhygienic. In the sixth five year plan (1980-85), provi-

sion was made for creating water supply facilities in the identified problem villages under the Minimum Needs programme and the centrally sponsored Rural water supply programme. Inspite of massive efforts in the sixth plan, 39,000 problem villages remain which have no source of potable drinking water. They are being taken up on a priority basis during the seventh plan (1985-1990).

Minimum Needs programme was introduced in the fifth five year plan to provide the basic needs of life to every citizen. The objective of this plan is to provide for certain basic minimum needs and thereby raise the living standards of the people. The basic need of the people identified for this programme are : elementary education, adult education, rural health, rural water supply, rural roads, rural electrification, rural housing, environmental improvement of urban slums and nutrition.

IN the field of rural health, the objectives to be achieved by the end of the seventh five year plan, under the minimum needs programme are : one PHC for 30,000 population in plain and 20,000 population in tribal and hilly areas, one sub - center for a population of 5000 people in the plain and for 300 in tribal and hilly areas and one community health centre (rural hospital) for a population of one lakh or one C.D. Block by the year 2000.

STATEWISE MALE-FEMALE LIFE EXPECTANCY
AT BIRTH FOR THE PERIOD 1970-75

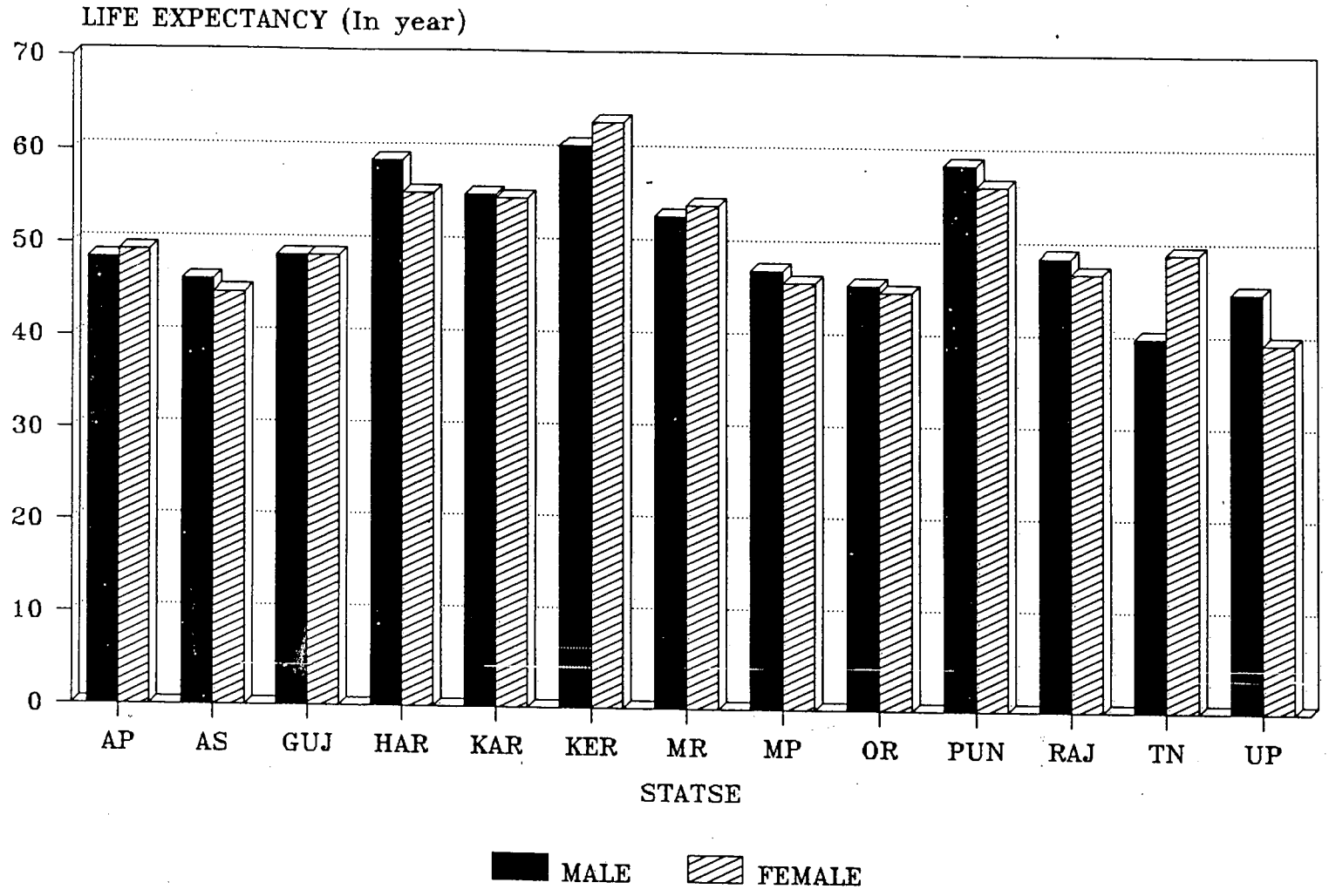


FIG:2.4

There is also maldistribution of health manpower between rural and urban areas. Studies in India have shown that there is a concentration of doctors (upto 80 percent) in urban areas where there is only 20 percent of population (Park : 1987).

2.7 Sex Differential in Life Expectation

In almost all societies the differential in life expectancy in males and females exists. In developed societies female longevity exceeds that of males and mortality rates are lower for females at all or almost all ages.

The sex differential has been studied with the concept that the longevity of female is greater than male.

In 1970-75 (as the fig. 2.4 shows) almost all the states of north India like Haryana, M.P., Orissa, U.P., Punjab had higher life expectancy for males than for female. This differential was highest in U.P. which is of 5 year. rest of the states had very marginal differential that was not more than three years.

But in 1986-90 the scenario has been changed. The graph 2.5 shows that all the south Indian states have more female life expectancy than male. The differential between them is declining in even north Indian states, still male life expectancy is dominant over female. These states are Bihar, Madhya Pradesh, Orissa, and Uttar Pradesh.

STATEWISE MALE-FEMALE LIFE EXPECTANCY
AT BIRTH FOR THE PERIOD 1986-90

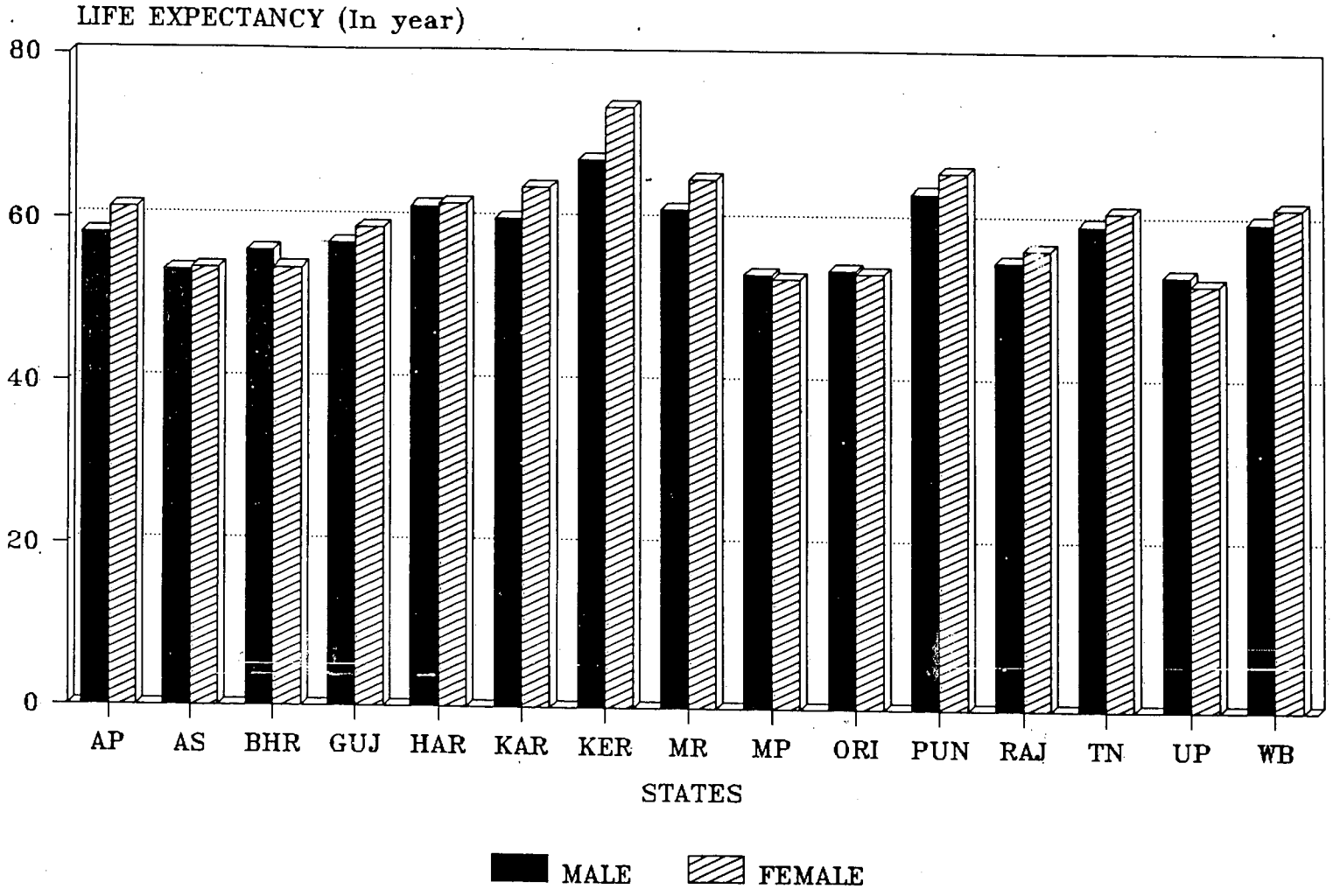


FIG:2.5

Kerala gives very different picture, where female life expectancy exceeds that of the males with the difference of 6 years. The Easter States of Orissa and Assam show almost same life expectancy for both males and females. The western states of Gujarat and Rajasthan show more female life expectancy than males. The differential of life expectancy in these two states are marginal.

So the 1986-90 pattern shows that south India has already more life expectancy for females than males The Western states ranks second approaching to the target followed by Eastern state. The states which come in last are U.P. and Madhya Pradesh. Punjab and Haryana show females life expectancy exceeding males.

2.8 Conclusion

The overall description shows that there is general decrease in mortality do there is increase in life expectancy. There is decline in rural urban and male female differential with the introduction of various programmes under five year plans. e.g. safe National Water Supply and sanitation programme, Community Development programme, establishment of primary health centre, Minimum needs programmers etc. Rural India's life expectancy is lower than the national overage. Due to socio economic backwardness BIMARU (Bihar, Madhya Pradesh Rajasthan, and Uttar Pradesh)

show very low life expectancy. In sex differential all these northern states have male life expectancy more than female. Gender bias is more prominent in north Indian states. Compared to this the south Indian states are in a better position and have more life expectancy than that. Kerala gives very outstanding picture throughout history with high level of social development and life expectancy both for male and females. The unique picture it gives is that the rural life expectancy is higher than urban, very unlike the trend in developing countries. This pattern was generally found in the initial period of industrial development in European Countries where urban life expectancy was lower than the rural life expectancy.

CHAPTER - III

SPATIO-TEMPORAL PATTERN OF INFANT MORTALITY RATE AND CHILD DEATH RATE

A: INFANT MORTALITY RATE
B:CHILD DEATH RATE

3.1 Introduction

The infant mortality rate and child death rate are considered to be sensitive indicators of the socio-economic and health conditions prevailing in a community. It is often used to reflect the state of public health, environmental sanitation, socio-economic development and the people's attitude towards the value of human life itself in a country (Dutta & Kapur: 1982).

Studying infant mortality rate and child death rate in the India context helps us to know its condition and the important determinants which affect the same. In the country itself, there are variations at the sub-national level including rural-urban and male-female differentials.

This chapter is devoted to the study of infant mortality (section A) and child death rate (Section B). The inter-state as well as sex-differentials are also briefly discussed.

Since infant mortality rate of India has been studied here, it is necessary to know the world trend of infant mortality rate. Infant mortality rate decreased during the past decade more sharply in the developing countries than as a whole in the least developed countries. The gap in infant mortality rates between developed and developing countries has narrowed during the decade. The pace of change and the

magnitude of improvement have varied considerably among countries. Yet, an infant born in a developing country was, on or average 5 times more likely to die during the first year of life than one born in a developed country.

Table 3.1 : World Trend of Infant Mortality Rate

States	1975-80	1980-85	1985-90
World Total	86	79	70
More Developed	19	16	15
Less Developed Region	97	89	78
Africa	126	116	103
Eastern Asia	91	83	72
South Eastern Asia	89	75	63
Southern Asia	127	113	102
Afghanistan	183	183	172
Bangladesh	137	128	119
India	126	110	99
Sri Lanka	44	35	28
Europe	19	15	13
Occania	35	30	26

Source: Report on the world social situation, 1993 U.N.

as per Table 3.1 Africa has the highest infant mortality rate in the world despite a decline from 126 per thousand live birth in 1975-80 to 103 in 1985-90. Infant mortality rate in Mauritius fell to 23 per thousand, an exceptionally low level in Africa. Even more remarkable was the achievement in Egypt, where infant mortality rate declined from 115 per thousand live birth in 1980-85 to 65 in 1985-90. In general, the decline in Western Africa was

moderate at best, with infant mortality rate in Sierra Leone still above 150 per thousand. In Latin America and the Caribbean region infant mortality rate ranged from 11 per thousand live birth in Barbados during 1985-90 to 110 in Bolivia.

Infant mortality rate varied enormously among the countries in Asia, ranging from 5 per thousand live birth in Japan to 172 . In Afghanistan 1985-90. Remarkable gain were made in Hongkong, Singapore, Sri-Lanka and Thailand. Infant mortality rate in Afghanistan, Bangladesh and India remained exceptionally high. Compared to southern Asia South East Asia has less infant mortality rate that is 102 and 63 respectively in 1985-90. In Asia, minimum infant mortality rate found in the Eastern part is about 31 per thousand life birth (UN : 1993)

As far as India is concerned infant mortality rate was very high in the pre-independence period. The annual Report of the Sanitary commissioner of India in 1864 showed the annual infant mortality rate in some provinces to be as high as 400 per thousand live births. Since 1920, reports of the public health commissioner to the government of India are perhaps the only source of Information about the infant mortality rate. It may, however, be mentioned that these rates are based on statistics of registered events which are

grossly deficient, both qualitatively and quantitatively. The conceptual variations with regard to inclusion and non-inclusion of still births with infant deaths might also have been responsible for a good deal of errors. A relatively greater undercount of infant mortality than live birth leads to a further deflation of infant mortality rates (Dutta and Kapur : 1988).

Infant mortality rate was recorded highest during the decade 1911-1921, which was mainly due to the influenza epidemic in 1918. The steadily declining trend is noticeable since the 1930's. The rate of declined from 167.7 per thousand live births in 1931 to 139 in 1961. Although proportionately the decline in infant mortality rate is less than the percentage decline in general mortality, the fall in infant mortality rate contributed significantly to the reduction in general mortality. Infant mortality in India around 1958, based on the 14th round of National Sample Survey was 146 per thousand live births (Kohli : 1977)

To improve the reliability of estimates of vital rates, the office of the Registrar General, India initiated the Sample Registration Scheme (SRS) in 1964-65. This scheme provides comparatively more reliable estimates of infant mortality. As the table 3.2 shows the trend was very high

before independence and it was sharper in 1905 - 1910. The infant mortality was 228 per thousand live birth, that is more than previous years. Although it declined in the next five year that is 1911-15, again it increased in 1916-20. After that the gradual declining trend can be observed. This was more sharp just after Independence, in which it reduced from 161 per thousand live births to 134. There was again fluctuation in 1951-61.

The other table 3.3 shows IMR from 1971 to 1994. The table show gradual decline till 1984, when infant mortality was 104 per thousand. After that IMR in India comes under 100. Between the period of 1988 and 1990, the table 3.3 shows drastic decline in infant mortality deaths when IMR decline from 94 per thousand live births to 80 per thousand live birth. In 1994 it reaches 73 per thousand live births. The urban trend of IMR shows drastic decline between the period 1984-85 and 1988 to 1990. Now the urban infant mortality rate is 70./51 per thousand live birth

Table 3.2 : Trend of Infant Mortality Rate in India From 1900 to 1961

Periods	IMR (Per thousand live births) five years average
1900-1904	215
1905-1910	228
1911-1915	204
1916-1920	219
1921-1925	174
1926-1930	178
1931-1953	174
1936-1940	161
1941-1945	161
1956-1950	134
1951-1961	146

Source : Health Information India : 1992.

Table 3.3 : Trend of Infant Mortality from 1970 (per thousand live birth)

Period	Rural	Urban	Combine
1970	136	89	129
1975	139	80	129
1980	124	65	114
1985	107	59	97
1988	102	61	94
1990	86	51	80
1992	85	53	79
1993	82	45	74
1994	79	51	73

Source : Sample Registration System

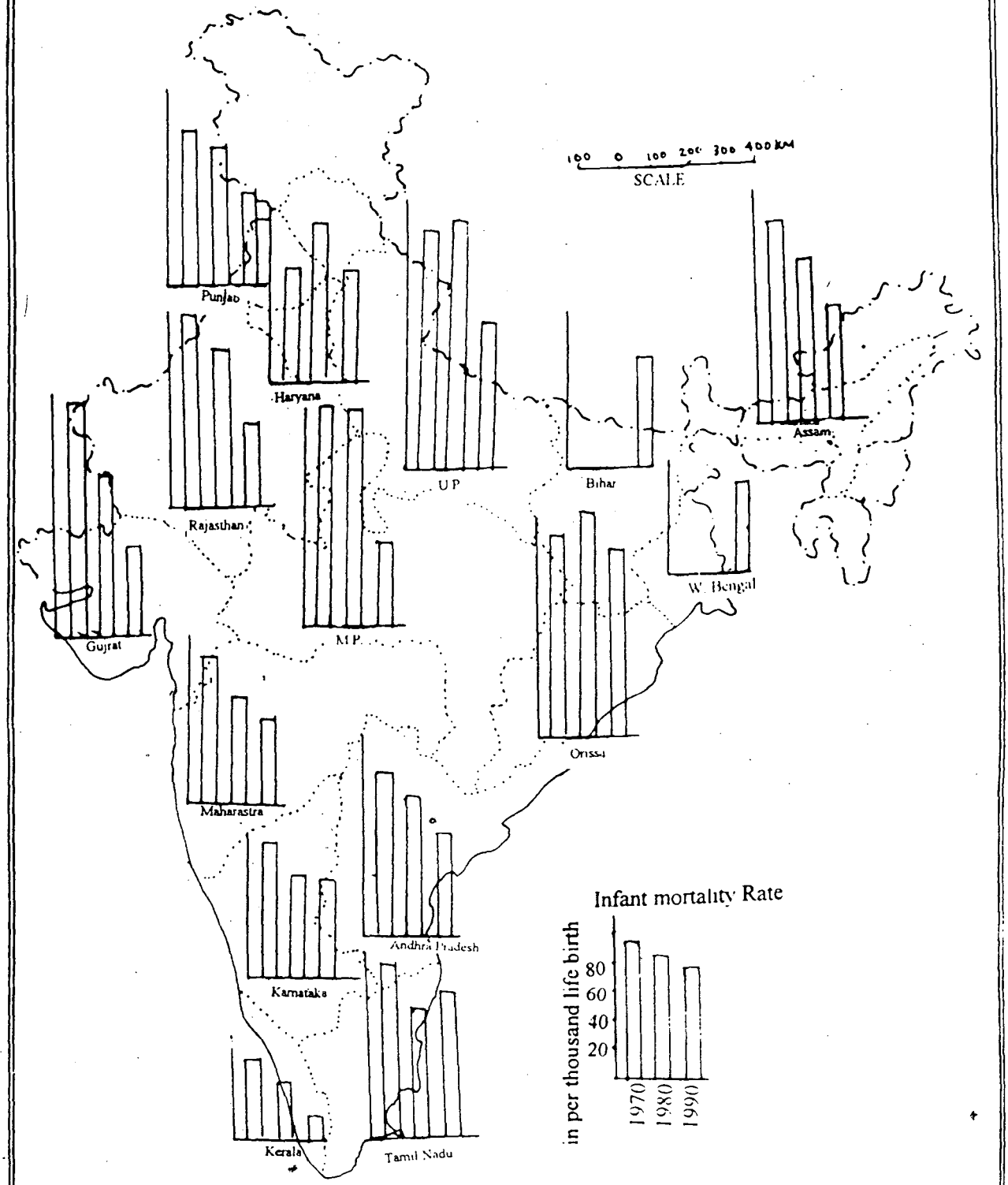
Rural India shows comparatively higher infant mortality than urban India. The decline is sharper between 1988 to 1990 when it declined from 102 to 86 per thousand live birth Inspite of these declines Infant mortality is still high, especially in the rural sector.

MAP NO 3.1

INDIA

INFANT MORTALITY RATE

(1970, 1980, 1990)



NOTE : NO DATA AVAILABLE FOR BIHAR AND WEST BENGAL FOR THE PERIOD 1970 AND 1980

3.2 Interstate Variations in Infant Moratality Rate since The Begning of 1970.

During 1970's there were few states whose infant mortality rate was higher the than national average. These states were Gujarat, Madhya Pradesh, Orissa and Uttar Pradesh with infant mortality rate 153, 144,m 133 and 154 per thousand live births respectively. The states like Tamil Nadu, Rajasthan, Punjab, Assam and Andhra Pradesh had infant mortality rate below the national average and varied from 129 to 100. IMR below 100 was found in Maharashtra Karnataka, Haryana and Kerala. Kerala had the minimum infant mortality rate of 58 and U.P. had the maximum of 154 in all over India in 1970. Even after the five years interval the trend was more or less the same. According to the map 3.1 Haryana showed some increase in its infant mortality rate. In 1980 the states like Uttar Pradesh, Madhya Pradesh and Orissa had very high IMR more than the Indian average. They were 159, 142 and 143 per thousand live births respectively. Assam, Gujarat and Maharashtra showed IMR around 100 while rest of states had IMR less than 100. Whole of north, west and eastern states of India except Punjab and Haryana had infant mortality rate higher than 100 (as per table 3.4 and the map 3.1).

The southern states had the minimum IMR below 100. 1980 to 1990 is the period when the decline is sharper. The IMR is just 80 per thousand live births. Improvement in health services, mother and child care programme, universal immunization programmes increase in literacy rate and more public awareness partly explain the declining trend.

Table 3.4 : Infant Mortality Rate in Different States for 1970, 1980 and 1990

States	1970	1980	1990
Andhra Pradesh	113	92	70
Assam	126	103	76
Gujarat	153	113	72
Haryana	78	103	69
Karnataka	95	71	70
Kerala	58	40	17
Maharashtra	98	75	58
M.P.	144	142	111
Orissa	133	143	122
Punjab	102	89	61
Rajasthan	123	105	84
Tamil Nadu	125	93	59
Uttar Pradesh	154	159	99
Bihar	---	---	75
W.B.	---	---	63

In the decade 1980-90 Orissa with 123 and Madhya Pradesh with 111 have the highest infant mortality rate. Rest of the Indian states enjoy less than 100 IMR.

Table 3.5 : Decadal Change in Infant Mortality rate in Different states

States	1970-80	1980-90
Andhra Pradesh	-18.5	-23.4
Assam	-18.2	-26.2
Gujarat	-26.1	-36.2
Haryana	32	-33
Karnataka	-25.2	-1.4
Kerala	-31	-5.75
Maharashtra	-23.4	-22.6
M.P.	-1.3	-21.8
Orissa	7.5	-14.6
Punjab	-12.7	-31.4
Rajasthan	-14.6	-20
Tamil Nadu	-25.6	-36.5
Uttar Pradesh	3.2	-37.7

Decadal change in infant mortality rate (according to the table 3.5) shows declining trend in both the periods 1970-80 and 1980-90. Rate of change varies among the states. As the table 3.5 shows the maximum change was found in Kerala, followed by Gujarat, Maharashtra, and Karnataka which was 31, 26.1, 23.4 and 25 percent respectively. And rest of the states showed hardly 10-20 percent change in their IMR. There were few states during 1970-80 decade, which showed increase in their IMR, like Uttar Pradesh, Haryana and Orissa. The maximum increase was 32 percent in U.P.

In 1980-90 there is no case of increase in infant mortality rate. Decreasing rate of infant mortality rate is

a positive sgin of health condition. Kerala has maximum rate of change followed by U.P., which is 37 percent, Gujarat 36 percent and Punjab and Haryana 33 and 31 percent respectively. The minimum rate of change is found in Karnataka.

The important conclusion of the above discussion are as follows :

1. In South India infant mortality rate is less than the states of north India.
2. Orissa, Madhya Pradesh (with large tribal population), Rajasthan, Bihar and Uttar Pradesh are the states which have higher IMR than Indian average.
3. During 1970 to 1980, U.P. had the highest IMR but now in 1990 it has shifted to Orissa.
4. The maximum change is to be found in Kerala. It is more than 50 percent over the past two decades.

So U.P. emerged as most socially and economically backward state. Nag (1983) explains lower IMR in Kerala is attributed to its higher social development and partly to its favourable environmental aqnd hygenic conditions. Development of social services, education, health and transportation through public policy measure were favourable factors. Kerala is also having more than 90 percent of female literacy and excellent health services.

Dyson and Moore (1983) explained the regional differences in IMR with status of women in which northern states showed lower female autonomy than the Southern states.

It is also becoming clear now that improving health service alone would not reduce the infant mortality rate. Other programmes such as food production and distribution, education, water supply and overall development can make a significant contribution towards achieving a better health status of infants, children and adults (Abel : 1988).

Table 3.6 : Relationship beteween Female Literacy and Infant Mortality Rate and Child Death Rate

States	Female Literacy rate 1991	IMR 1990	Child deaths rates (0-4 age group)
Kerala	86.1	17	4.6
Maharashtra	52.3	58	16.5
Tamil Nadu	51.3	59	17
Punjab	50	61	18.3
West Bengal	46	63	19.7
Haryana	40.4	69	21
Andhra Pradesh	32	70	20.7
Karnataka	44	70	21.1
Gujarat	48.6	72	26
Bihar	22	75	26.2
Assam	43	76	28.5
Rajasthan	20.4	84	29.5
Uttar Pradesh	25	99	35.9
M.P.	28.8	111	36.6
Orissa	34.6	122	39.4

As the above table 3.6 shows literacy has very strong effect on Infant and child mortality. The Table shows that beside other factors, the state with lowest infant and child mortality has the highest female literacy. And its reverse case can be seen in Orissa. With lower literacy rate 34.6 percent, this state has highest IMR 122 and 39.4 per thousand child death rate. So level of literacy also affects the inter-state variation of Infant mortality rate and child.

3.3 **Rural Trends** -

Infant mortality rate is higher in rural sector in south Asian countries but exception is there, that is Sri Lanka. In India infant mortality rate in rural sector is very high. The states of western and Northern India Gujarat, Madhya Pradesh, and Uttar Pradesh, showed very high infant mortality rate. the IMR was more than 150 per thousand live birth during 1970. Kerala and Haryana had IMR below 100 that were 55.9 and 32.1 per thousand live birth. Rest of the Indian states show IMR more than 100.

According to the table 3.7 rural rate of decline in IMR was very low, just 8 percent during the period 1970-80. During this period U.P. had the maximum infant mortality rate that was 167 per thousand live births. The states like Haryana, Orissa and U.P., showed the increase in infant

mortality rate is the period 1970 to 1980. The decline in Infant mortality in rest of India was approximately 20 percent, in which

Table 3.7: Statewise Decadal change in IMR in the rural sector

States	1970-80	1980-90
India	-8.8	-30
Andhra Pradesh	-15.7	-29
Assam	-23.9	-25.7
Gujarat	-25.2	-33.6
Harayana	35.2	-34.2
Karnataka	-21.1	1.2
Kerala	-26.6	-58.5
Maharashtra	-18	-23.8
M.P.	1	-.21
Orissa	7.2	-15.3
Punjab	-7.4	-31.2
Rajasthan	-22.2	-23.4
Tamil Nadu	-23	-32
U.P.	1.2	-37.1

Kerala showed its outstanding decline, which was 26 percent.

As per Table 3.7 during the 1970-80 decade U.P. emerged with maximum IMR. The utilization of health services is very low as one of the study of Khan says. According to Khan (1988) in U.P., the majority of deliveries are assisted by family members and neighbours and mortality level among these babies is extremely high as compared to those deliveries which are attended by untrained midwives or trained professionals. From the literature survey it was

observed that 40-50 percent of the population in U.P. was below poverty line and did not get the minimum required calories intake. Further, even in the families, distribution of food is far from equitable and the male members get much more than their female counterparts (Khan: 1988).

During the period 1980-1990 the decline rate in rural sector has been 30 percent as the table shows. The decline is comparatively faster than observed during 1970-80 decade. Except U.P. and Orissa all other states have rural IMR below 100 per thousand live births. Kerala shows IMR 17 per thousand live births.

According to Murthy and Kanitkar (1988) in rural Orissa only 25 percent of mother's had received pre-natal care services, 6 percent had delivered their last child in medical institute and 4 percent of home deliveries were attended by trained medical personnel. The corresponding percent for rural areas of Rajasthan were 9.5 and 8 percent respectively.

As for Madhya Pradesh Talwar (1988) says that 2/3 of infant mortality rate did not receive any medical attention at all. Utilization of MCH (mother and child care) services was limited. While 43 percent of the households had reported having used the services of health centres, only 4

percent of the women had utilized anti-natal services, 3 percent had received tetanus toxoid. The utilization of post-natal services was very low.

3.4 Urban Trend

Urban IMR is comparatively lower than rural at all the three points of time as it can be seen in the Table 3.8.

Table 3.8 : Statewise Infant Mortality Rate in The Urban Sector

States	1970	1980	1990
Andhra Pradesh	79	40	56
Assam	78	64	39
Gujarat	131	94	54
Harayana	61.4	53	53
Karnataka	73.4	45	39
Kerala	39	34	15
Maharashtra	84	52	44
M.P.	113	80	61
Orissa	103	62	68
Punjab	86	58	45
Rajasthan	104	50	59
Tamil Nadu	89	64	37
U.P.	110	99	67
W. Bengal	61(1972)		41
Bihar	75(1972)		46

The comparatively high level of literacy, better health services and less tradition bound people partly explain the low IMR in urban sector. The average urban India's IMR was 89 in 1970 when all the northern and western states (except Harayana and Punjab) had IMR more than 100. Even the table shows all these states have high IMR in 1990 also compared

to rest of the Indian states. Except Andhra Pradesh with IMR 56 all the south Indian states have IMR below 50 per thousand live birth.

Table 3.9 : Statewise Decadal change in IMR in urban India

States	1970-80	1980-90
Andhra Pradesh	-49.3	40
Assam	-17.9	-76
Gujarat	-28.2	-42.5
Harayana	-13.6	0
Karnataka	-38.3	-13.3
Kerala	-12.8	-55
M.P.	-29.2	-23
Maharashtra	-38	-15.3
Orissa	-39	9.6
Punjab	-32	-22
Rajasthan	-51.9	18
Tamil Nadu	-28	-42
U.P.	-10	-32
India	-26	-21

Decadal change as the table 3.9 show was maximum in Rajasthan while it was minimum in U.P. during 1970-80. The rate of decadal change increases in next decade 1980-90. It shows the decline in IMR but Rajasthan is the state where instead of decline there is increase in IMR. Even Andhra Pradesh shows increase in IMR at 40 percent rate. Harayana does not show any change. Th decadal rate of change in IMR for the period 1980-90 show 21 percent while it was 26 percent in 1970-80. So the rate of change declined during the period of time. From the given table 3.9 it can be seen

STATEWISE RURAL URBAN INFANT MORTALITY RATE, 1970

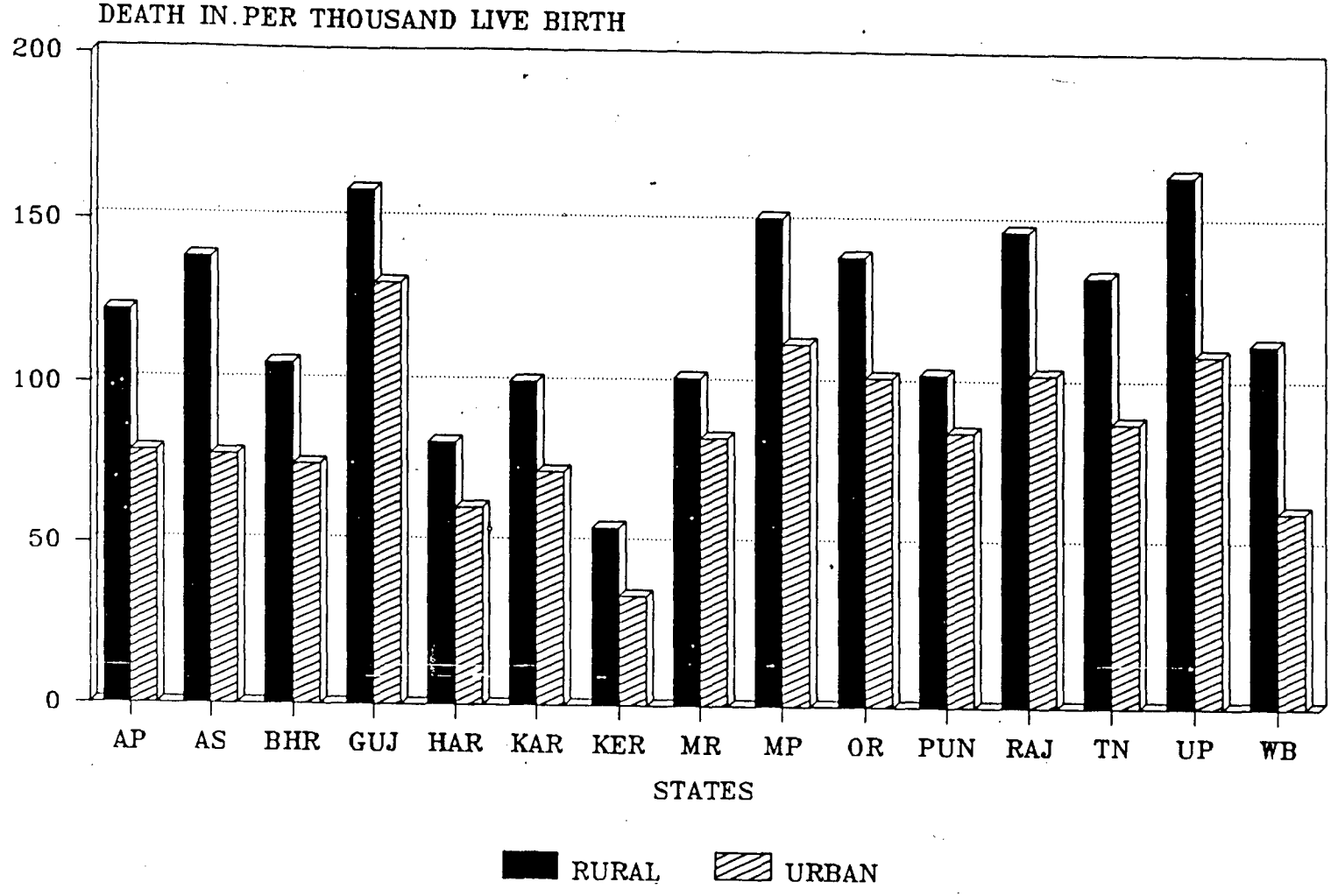


FIG:3.1

that Andhra Pradesh, Orissa and Rajasthan show increase in IMR and rest of the India shows decline in IMR. This decline rate varies from 76 percent in Assam to 13 percent in Karnataka.

3.4.1 **Rural Urban Differential**

According to the graph 3.1 of 1970, the rural-urban differential was very wide. It varies from Assam with 60.4 points to Kerala 16.4 points. Since rural IMR is higher than urban IMR, so the states which show large differential means that state has very high IMR rural sector and low in urban sector. The differences of 55 to 40 points was found in Rajasthan, Tamil Nadu, U.P., W. Bengal and Andhra Pradesh. Orissa and Maharashtra show the difference of 36.8 and 38.7 points in the period 1970. The minimum differences are found in Kerala, Punjab and Madhya Pradesh with 16.9, 17.7 and 18.5 points.

The large differences of rural urban become less sharp after 20 years according to graph 3.2. In 1990, the range of difference varies from minimum 2 points to maximum 59 points in Kerala and Orissa and M.P. respectively. The states which showed less differential in 1970, are now showing very wide differences. Like M.P. had only 18.5 points of difference in 1970, now it becomes 59 points as the graph 3.2 shows. Karnataka had previously only 28 points of

STATEWISE RURAL URBAN INFANT MOTALITY
RATE 1990

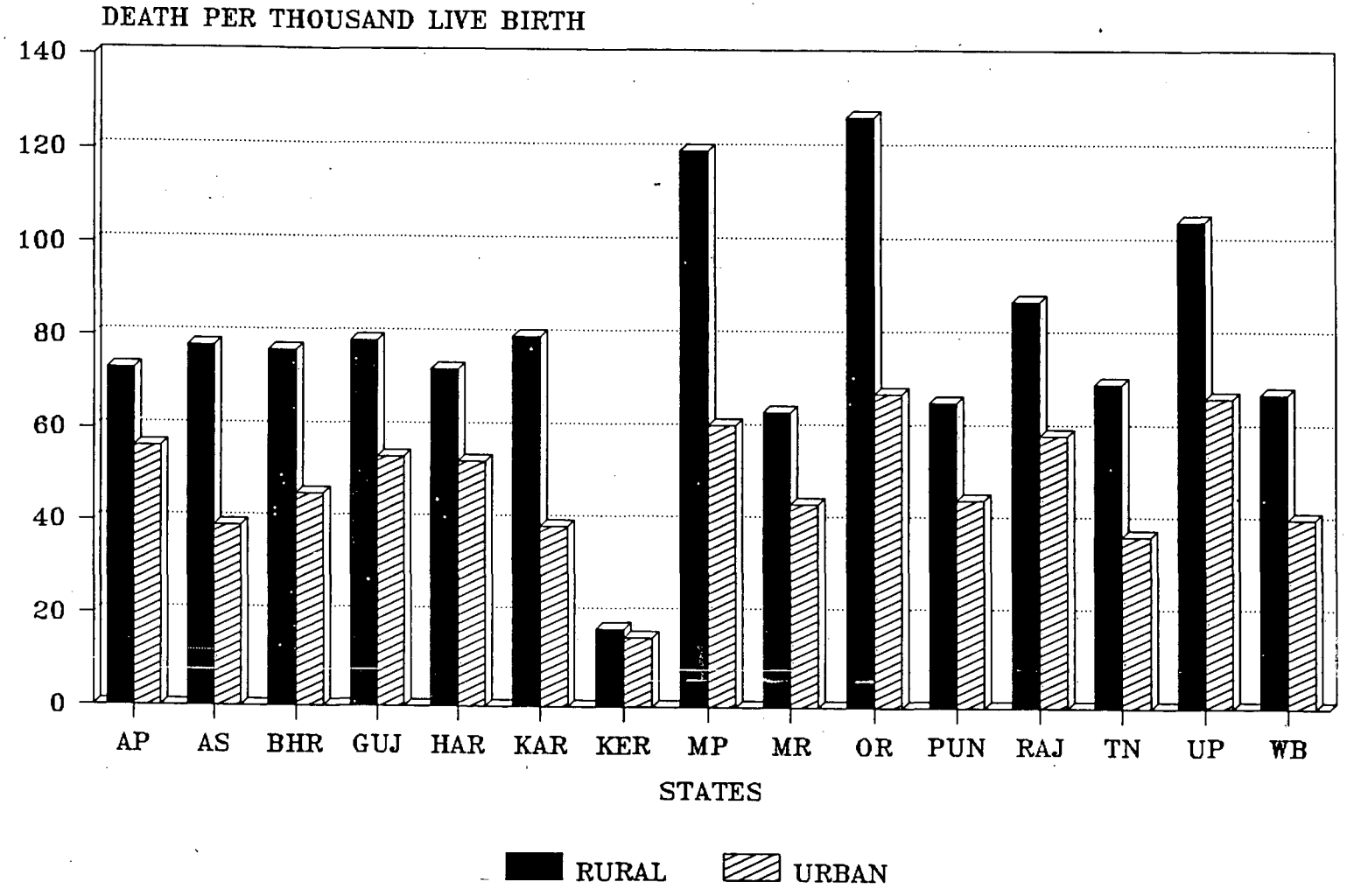


FIG: 3.2

differences now it shows difference of 41 points. Surprisingly the states which had wide differences in 1970, the difference become milder in 1990, like Rajasthan, the differential was 44 points in 1970 and 1990, it reduces up to 29 points. Again here Kerala gives a very outstanding picture, in which rural - urban difference was marginal (16 points) in 1970 and now it become negligible.

Table 3.10: Relationship of Infant mortality rate and health services in different states, 1990

States	Rural		Urban	
	(IMR)	Hospital bed / population ratio	IMR	Hospital bed / population ratio
Andhra Pradesh	73	.76	56	18.3
Assam	78	1.69	39	44
Gujarat	79	1.85	54	29
Harayana	73	.44	53	17
Karnataka	80	.81	39	22.7
Kerala	17	19.2	15	42.5
M.P.	120	.3	61	13.1
Maharashtra	64	1.8	44	27.5
Orissa	127	.93	68	26
Punjab	66	2.5	45	20.9
Rajasthan	88	.3	59	13
Tamil Nadu	70	2.5	37	30
U.P.	105	--	67	--
Bihar	77	3.06	46	22
W. Bengal	68	--	41	--

The above table 3.10 shows that the states with high infant mortality have low hospital bed and population ratio e.g. Orissa has IMR 127 and hospital bed and population

ratio .93. Kerala has 17 IMR and 19.2 hospital bed ratio. So from the study of given table 3.10 we can reach the conclusion that infant mortality is very much affected by health services. The urban sector shows low IMR and high hospital bed and population ratio e.g. Assam has 39 IMR and 44 hospital bed and population ratio. The minimum hospital bed and population rate in urban sector occur is in Rajasthan and M.P. that is 13.1 and 13. Their IMR is 59 and 61 per thousand live birth respectively. From the observation the picture emerges that rural sector of different states have high IMR with low hospital bed and population ratio and urban sector is just opposite. There is a wide disparity between rural and urban sector in the context of available health facilities.

Even the literature shows the difference in rural and urban facilities in health service. According to the study of Padmanabha (1982) 75 percent of rural births are attended by untrained medical practitioner as against 38 percent in the urban sector. In rural areas, neo-natal mortality is higher than post neo-natal mortality. It is just double than that in the urban area. This is again a reflection of the lack of proper medical facilities in the anti-natal period of expectant mothers, and the lack of maternal and child health care in the rural area would appear to be

STATEWISE SEX DIFFERENTIAL IN INFANT MORTALITY RATE FOR 1980 AND 1992

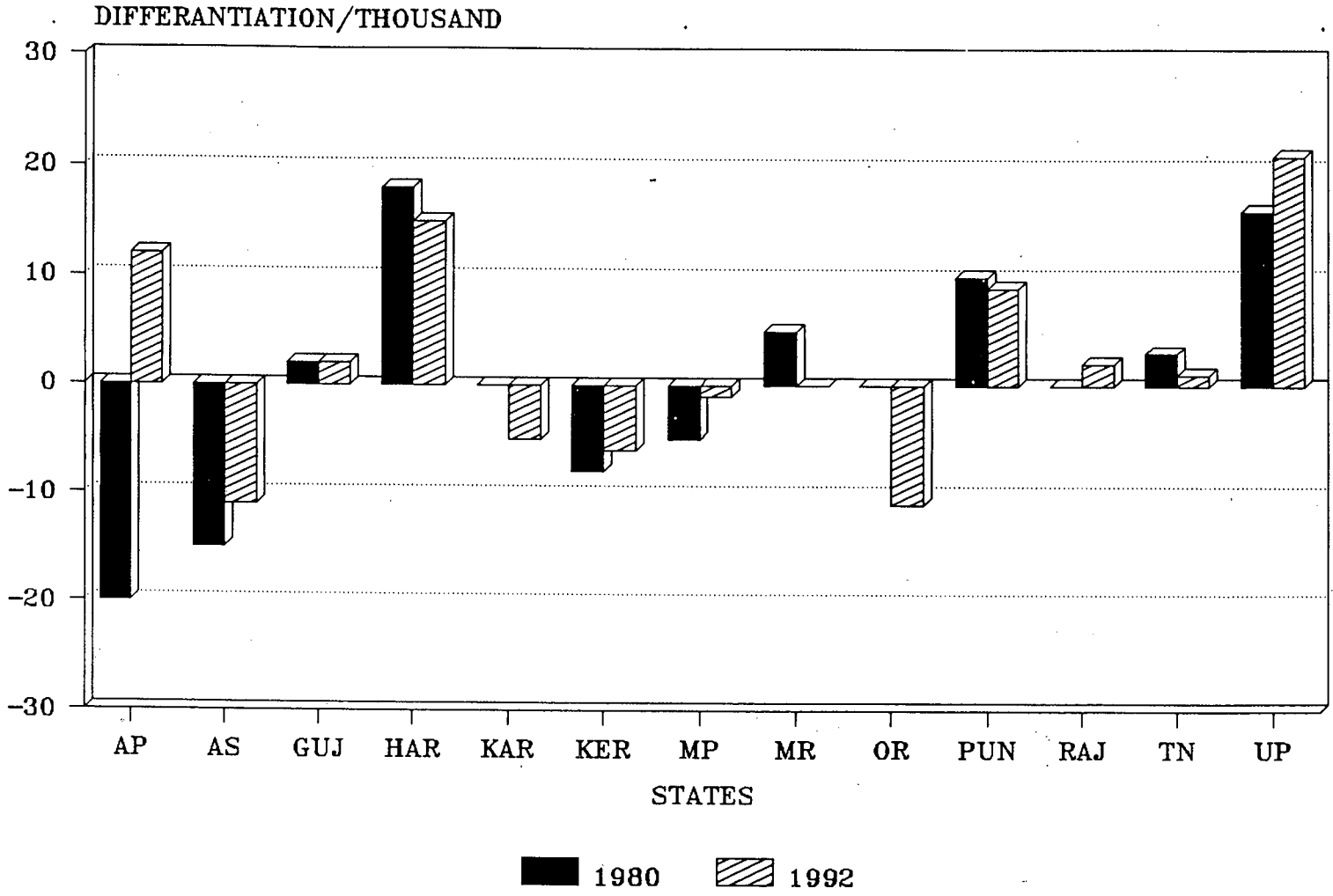


FIG:3.3

contributory factors for the higher levels of mortality in the rural areas among infants (1982). According to the recent SRS data (1992) in India only 18 percent of delevery has been done in any medical Institutions in rural sector, while in Urban sector it is 54 percent, 60.2 percent delivery has been attended by untrained medical praclelner in rural sector while it is just 17.2 percent in urban sector (SRS : 1992)

3.5 Sex Differential in Infant Mortality Rate

Sex differences in infant mortality rate is a good indicator of the value system and the social customs relating to the care of babies. It may be called the reflection of social and cultural framework. In developed countries infant mortality rate among males is almost invariably higher than females, but in several of the third world countries including India, it is found to be lower among males than females.

Here the discussion of sex differential is done with this view that female IMR is always higher than male. Where the result of differential is positive, it means that female IMR exceeds male IMR. But where the result is in negative, it means that male IMR exceeds female IMR.

Sex differential in infant mortality rate in 1970 was not much sharper in both rural and urban sector. But in

rural sector almost all of the states show female IMR exceeded male as shown in the Table 3.11.

Table 3.11: Sex differential in IMR (Female-male) in different states

States	1970 Rural	1970 Urban	1980	1992
Andhra Pradesh	-29	-20	-20	12
Assam	4	-27	-15	-11
Bihar	--	--	--	3
Gujarat	1	5	2	2
Harayana	-9	-15	18	15
Karnataka	4	-21	0	-5
Kerala	4.2	-3.6	-8	-6
M.P.	4	-3.5	-5	-1
Maharashtra	5	-8.4	5	0
Orissa	5.7	-11.3	0	-11
Punjab	-5	-21.5	10	9
Rajasthan	-4	-5	0	2
Tamil Nadu	2.2	-44	68	3
U.P.	6.6	-5	16	21
West Bengal	--	--	--	-13

Andhra Pradesh was an exceptional case, where male infant mortality rate (that is expected) exceeded female. In urban sector in 1970, almost in every state male IMR exceeded female. The differential was maximum in Tamil Nadu, where it was 44 points. The moderate differential was found in Assam, Karnataka and Punjab.

In 1980, sharper differential was observed. It can be seen in the table 3.11 as well as in graph 3.3 also. The sharper differential can be seen in U.P., Harayana and

Punjab with 19, 11 and 22 points differences in infant mortality rate. In urban sector the gap is very marginal. But the differential was wider in Tamil Nadu in both urban and rural sector. U.P. and Harayana have the remarkable high female IMR than male. The same trend is also observed in 1992. Due to unavailability of data of 1990 for separately male and female the data of 1992 has been taken into consideration. From the table 3.11 and the graph 3.3, it is observed that in north India states female IMR is greater than male IMR. The literature related to Punjab also approve this. According to Kumar and Dutta (1988) in Punjab mortality among male was higher than among females in first 28 days but in the post neo-natal period, female mortality showed a sharp and significant rise. About 61 percent of post-neonatal mortality was reported among females.

In U.P. some of the cultural beliefs and practices put women in a disadvantageous position. Sometimes it creates the problem of malnurition in pregnant mothers and they give birth to low weight baby. Also the female infants with low birth weight may well become the mother of such infants themselves and hence, the vicious circle continues for generations (Khan : 1988). Abel (1988) mentioned in his study about female infanticide which was in practice in Tamil Nadu.

In one study (1985) Jain look female infants who received a triple vaccine as an indicator. The analysis shows that it varies from 1 percent in Assam, Orissa, Rajasthan and U.P. to 20 percent in Kerala and Maharashtra.

The above description of infant mortality rate, its rural urban and male-female differential shows that there is a great interstate variation in India. The level of IMR was very high in the early 1950s and even in 1970s but it declined slowly. The decade of 1990 shows the firm decline in IMR with the introduction of various direct and indirect intervention. The gap between rural and urban deaths although narrowed down but disparity between male and female is still there. The female discrimination is basically a social problem deeply rooted in its economic problem also. The social negligence of female leads to numerous complication in child birth. Beside these factors availability of basic infrastructure and health sanitation facilities etc. have their own importance. The states with all these facilities have very low infant mortality rate even there is small differential between rural-urban and male-female IMR. The best example one can give is Kerala for low IMR and U.P. with high IMR. One state is socially much developed and other is neither socially nor economically developed.

Child Death Rate

A nation may waste its forests, its water power, its mines and to some degree, even its lands, but if it is to hold its own in its struggle for supremacy, its children must be conserved at any cost. On the physical, intellectual and moral strength of the children of today the future depends.

- New York time editorial 1925

3.6 Introduction-

It has been increasingly realized that child death rate needs to be examined in addition to infant mortality rate. It is more refined indicator of social situation. It reflects the immediate environment including economic, educational & cultural characteristics of the family. By considering infant mortality rate only, one may not be able to estimate the level of early age mortality correctly. The causes of death of children are significantly different from those of infants so that programmes for reducing infant mortality rate and child death rate may not be identical. The information about its trend and level is important for health planners and policy makers (Population studies : 1988)

There are 500,000 new children born in the world every 24 hours. Nearly half of them (45 percent) are Asean, and they live in only five countries: China, India, Indonesia, Pakistan and Bangladesh Africa's children are increasing twice as rapidly as those of Asia, and three times faster than those of the rest of the world (Dogramaci: 1994).

A child born in one of the high mortality African and Asian countries today is on an average 20 times more likely to die before reaching the age of five, than a child in USA, Japan or Sweden. Of every 100 children born in Africa, 12 die before age one, 10 in every 100 die in Asia, 9 in the Near-East and 6 in Latin America. In Japan and Sweden fewer than 1 percent fail to reach their first birthday. Of 1000 children born in India, about 100 die during the first year, 40 more die during the second year, 25 in the third year and 10-15 in the fourth and fifth year. In other words, almost one-fifth of the children die before they are five years old (Ghosh: 1989). So it is true that Asia is the continental where the mass of our disadvantaged children live.

Child Death Trend - Deaths of children under 0-4 age group account for nearly 46 Percent of all deaths, while children of this age group constitute only 15 Percent of our population. (Gopalan : 1985). The trend of child death in India shows (table 3.12) that it is very high. It is more remarkable in rural sector.

Table 3.12: Trend of Child Death rate (0-4 age Group) in India

Years	Rural	Urban	Total
1970	58.1	32.3	52.9
1975	55.2	29.7	51
1980	45.0	20.0	37.5
1985	43.3	20.7	38.4
1990	29.1	15.6	26.5

Child death in the rural sector especially in 1970 is double than that in the urban sector. Because of high child death in rural sector, the total child death of India also shows a high rate. The rate of decline was gradual from 1970-75 in rural sector. As the table 3.12 shows the decline is very sharp between the period 1988 and 1990 from 43.3 rate to 29.1 . In the urban sector the decline can be seen in 1975 to 1980 but the 1980-85 period does not show any change, rather the urban rate slightly increased, but again in 1985-90, it declined. Because of these fluctuations, the total child death got affected and it increased slightly during 1980-85.

The level of child death rate varies considerably across the different parts of the country. In its wide regional disparity we observe, at one extreme there is Uttar Pradesh and Madhya Pradesh whose child death rate is higher than Indian average, while at the other end, Kerala

has child death rate less than half of the Indian average. The other states lie within this spectrum. The spatial variation remains despite a general improvement in child survival rates during the last three decades and so.

3.7 **Interstate Variation in Child Death Rate since the Beginning of 1970 -** The national average during 1970 was 52 in child death rate and very few states had rate lower than that. The states with high child death rate were Gujarat, Madhya Pradesh, Orissa, Tamil Nadu and U.P., whose range varied from 56 to 71. Gujarat was the state

Table 3.13 : Child Death Rate in India

States	1970	1980	1990
Andhra Pradesh	44	31.7	20.7
Assam	44.4	36.2	28.5
Gujarat	71.4	45.2	26
Harayana	30	37.5	21.8
Karnataka	37.5	28.8	21.1
Kerala	24.5	13.2	4.6
M.P.	56.2	58	39.4
Maharashtra	38.7	29	16.5
Orissa	56.4	47.1	35.9
Punjab	38.9	30	18.3
Rajasthan	--	48.1	29.5
Tamil Nadu	47.1	35.5	17
U.P.	68.7	63.5	36.6
Bihar	--	48.5	26.2
W. Bengal	--	27.3	19.7

Which had the highest level of child death rate. The minimum rate was found in Kerala. The states which enjoyed

moderately low level were Haryana, Maharashtra, Punjab and Karnataka which varied from 30 to 38. So it can be observed that the whole country shared high level of child deaths (see the table 3.13).

1978 was the period when immunization programme was started in India. Its effect can be seen on the decline trend. Inspite of that, Uttar Pradesh has the highest level of child death rate in 1980, that was about 63.5 per thousand. The lowest rate of child death occured in Kerala, which was 13.2 per thousand. Gujarat, M.P., Orissa, Bihar and Rajasthan had child death rate of more than 40 per thousand, while Punjab, Haryana and Tamil Nadu had moderately high level of child death rate. Karnataka, Maharashtra and west Bengal had child death rate below 30 per thousand so even in this decade North India except Punjab and Haryana showed high child death rate. According to Ghosh (1989) 1980 was the period where about 1.5 million children died of diarrhoeal diseases, 1.5 - 2 million died of acute lower respiratory injections and about 1-3 million died of diseases preventable by immunization, mainly neo-natal tetanus and measles. Pregnancy and delivery related deaths also accounted for 10 Percent of the infant deaths, low birth weight babies contributing a significant number. Malnutrition contributes to infectious diseases and infec-

tious in turn decrease food absorption, and worsen the level of malnutrition and a vicious circle begins.

In 1985, there was a marginal decline but this decline is particularly noticeable in 1990 child death rate. The decline is very sharp in the state of Maharashtra, Tamil Nadu, Punjab and west Bengal where child death rate has been recorded as 16.5, 17, 18.3 and 19.7 respectively. Kerala presents an excellent example of decline in child death rate. It reaches its minimum level that is 4.6 with its historical background and social and demographic development. But some of the north and eastern states of India either because of low level of socio-cultural and economic development or large tribal population share high level of child death rate. These states are U.P., Madhya Pradesh and Orissa with rate of child death of 36.6, 39.4 and 35.9.

With the help of various health programmes and integrated child development scheme Tamil Nadu improved its condition and now with Maharashtra, Punjab and West Bengal, its child death rate is below 20.

Table 3.14 : Statewise Decadal Change in Child Death Rate

	1970-80	1980-90
Andhra Pradesh	-28.2	-34.1
Assam	-18.1	-21.7
Gujarat	-36.6	-41.7
Haryana	-23.3	-41.8
Karnataka	-31.5	-27.7
Kerala	-64.3	-65.1
Madhya Pradesh	3.2	-32
Maharashtra	-23.6	-43.2
Orissa	-16.6	-23.7
Punjab	-23.6	-40
Rajasthan	-20.1	-39.5
Tamil Nadu	-24.1	-52.1
Uttar Pradesh	-17.5	-42.3

The table 3.14 shows a declining trend in general but there are few states which show increase trend. These states are Haryana and Madhya Pradesh with rate of increase 23.3 and 3.2 Percent. A sharp decline was found in Kerala with declining rate 64.3 Percent. Gujrat, Karnataka, Andhra and Maharashtra showed moderate rate of decline in decadal change during 1970-80. The decline rate below 25 was found in Assam, Orissa and U.P. with 18.1, 16.6 and 17.5 Percent.

The decline is shaper during the decade of 1980-90 The rate of change is higher more than 30 Percent in most of the states. Some states enjoy decline rate of more than 50 Percent. Lowering of child death rate is an indicator of overall well being as well as reflection of improvements in health.

The above description shows that child death rate is higher in northern and eastern India and in Tamil Nadu in South India. Although it declined during last twenty years still it is high in U.P., Orissa, Gujarat and Madhya Pradesh. Although it is very difficult to draw the line of demarcation for north and south, but it is clearly visible from the table 3.14. States like Kerala, Karnataka and Maharashtra with better utilization of health services enjoy low level of child death.

One important observation of this discussion is that those states which have high infant mortality, have also high child death and the states with low infant mortality have low child death.

3.8 **The Rural Urban Trend-** As the table 3.15 shows the level of child death rate was very high in rural sector during 1970. Compared to the rural sector the urban area showed low level of child death rate but still it was high. Gujarat, M.P., Orissa, Rajasthan, Tamil Nadu and U.P. showed child death rate more than 50 per thousand in rural sector. U.P. and Gujarat showed maximum child death rate of 81.8 and 73.1 per thousand respectively. The minimum child death rate occurred in Kerala with 23.8 per thousand. Maharashtra. Punjab and Karnataka showed the rate of child death less than 50 per thousand (see the Table 3.15).

STATEWISE RURAL URBAN CHILD DEATH RATE
(0-4), 1990

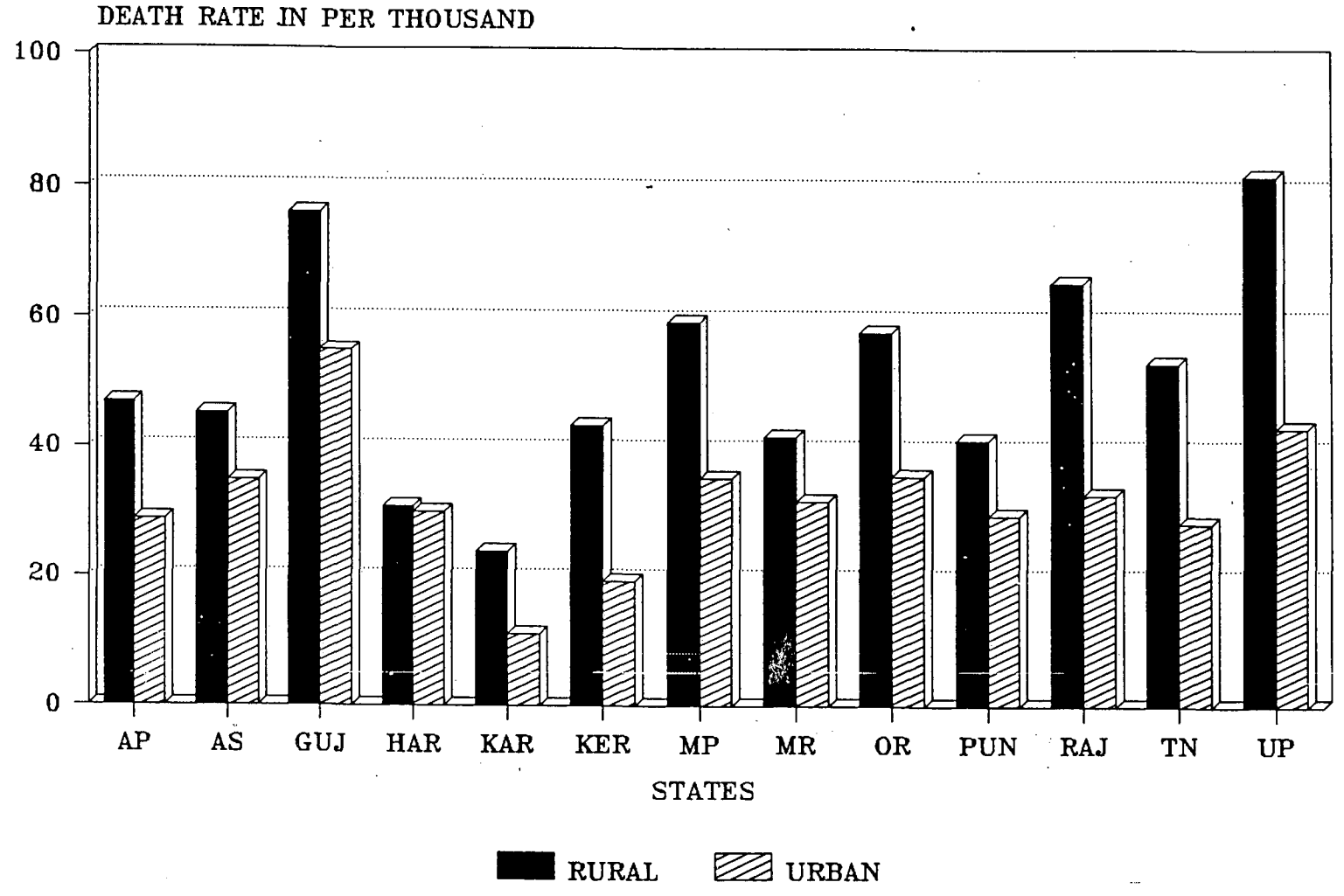


FIG: 3.4

Compared to the rural sector of 1970, the urban sector had low rate of child death.

Table 3.15 : Rural-urban Child Death

States	1970		1980		1990	
	Rural	Urban	Rural	Urban	Rural	Urban
Andhra Pradesh	47.0	28	39.2	13.4	22.1	15.3
Assam	45.3	34.8	37.4	18.9	29.3	14.0
Gujarat	73	55	49	33.8	29.8	17.7
Harayana	46	19.2	33.8	15.1	24.4	11.2
Kerala	33.8	20	13.6	11.4	4.7	3.9
Madhya Pradesh	59.3	35.2	64.1	27.4	43.9	18.7
Maharashtra	41.6	31.7	33.7	17.7	17.3	12.2
Orissa	57.8	35.6	49	23.8	37.4	19.0
Punjab	41.2	29.5	32.5	21	20.0	13.4
Rajasthan	65.5	32.6	53.2	23.5	39.8	17.8
Tamil Nadu	53.1	28.3	40.7	22	20.5	9.7
U.P.	81.8	43.1	67	35.2	39.4	22.8
Bihar					27.3	14.1
W. Bengal					21.5	12.4

The maximum child death rate was found in Gujarat with 55 per thousand. Other wise, the rest of the states had below 50. The minimum rate occurred in Karnataka with 19.2 and Kerala with 20. The northern and Eastern states' rate varies between 30 to 40. U.P. showed child death 43.1 per thousand.

During 1980 child death rate in rural sector declined almost in every state except Haryana, where it increased and became 40.3 per thousand. Madhya Pradesh and U.P. showed child death rate more than 60 per thousand, those rate were

STATEWISE RURAL URBAN CHILD DEATH RATE
0-4, 1990

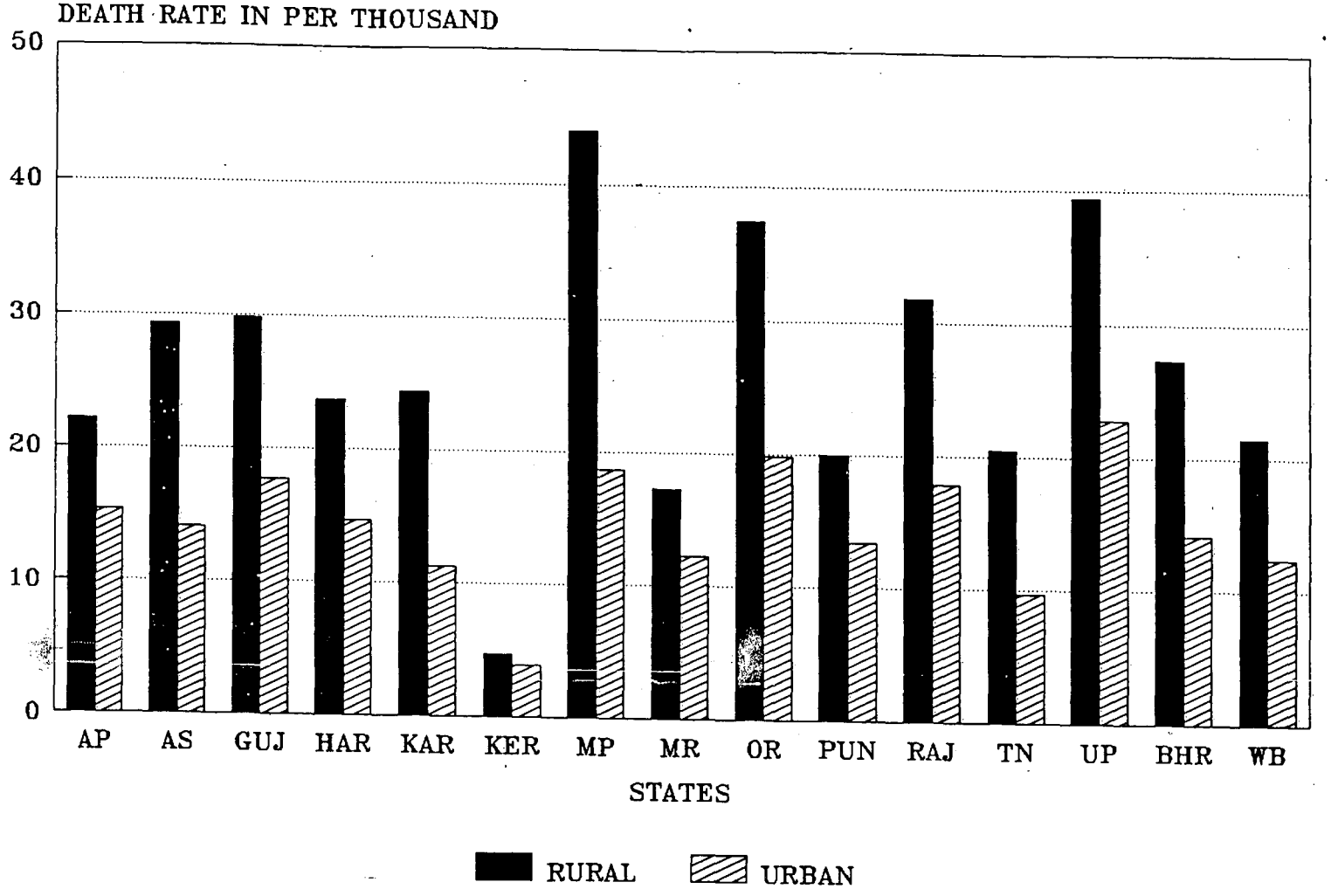


FIG: 3.5

67 and 64 respectively. Kerala as usual showed drastic decline. Rest of the Indian state's rate varies between 30 and 50. The average rate of urban sector varies between 20 to 40. Karnataka, Maharashtra and Kerala presented a very outstanding picture with child death rate 15.1, 17.7, and 11.4 respectively.

The rural sector in 1990 show drastic changes. The maximum rate of child death is around 40 per thousand, which is lower than 1980's rate. The graph 3.4 and 3.5 also show that the rural urban has declined difference from the period 1970 to 1990. The minimum differences can be seen in the state of Kerala. The wide differences in rural-urban sector can be seen in the states of Orissa, M.P., Rajasthan and U.P.

In rural sector during 1990, the average rate of child death rate varies between 20 to 30 per thousand except the cases of Orissa, M.P., Rajasthan and U.P. where it is high. In urban sector rate of child death varies between 10 to 20 per thousand with exception that is U.P. It has child death rate 22.8 per thousand.

So from the above discussion it is found that rural-urban differential is wide in both periods; now it is more prominent in the northern and eastern states where urban child death rate declined more than rural. The differential

in them can be the result of many factors e.g. lack of health services or safe drinking water.

According to Padmanabha (1982) in the rural sector only 57 Percent of child deaths are treated by a medical practitioner while it is 77 Percent in urban areas.

Safe drinking water has its own role which affect child health. According to the UNICEF Report, in India, the percent of rural people with access to safe water has risen from 30 Percent in 1980 to about 80 Percent in 1992 and according to the present trend will reach almost 100 Percent by 1997 or 1998 (UNICEF : 1995).

But according to the Indian census data, the percent of household having safe drinking water has increased from 37.91 Percent in 1981 to 62.72 Percent in 1991. The increase is noticed both in rural and urban parts of India. In rural areas the percentage of household having access to 'safe drinking water' has more than doubled from 26.34 percent in 1981 to 55.92 Percent in 1991. Similarly, in the urban parts of the country, the availability has improved i.e. from 74.13 Percent in 1981 to 81.59 in 1991.

Although the data of UNICEF and Indian Census vary, there is an improvement in the availability of safe drinking water and it has positive effect on child survival in both rural and urban sector.

STATEWISE SEX DIFFERENTIAL IN CHILD
DEATH RATE IN 1970 AND IN 1990

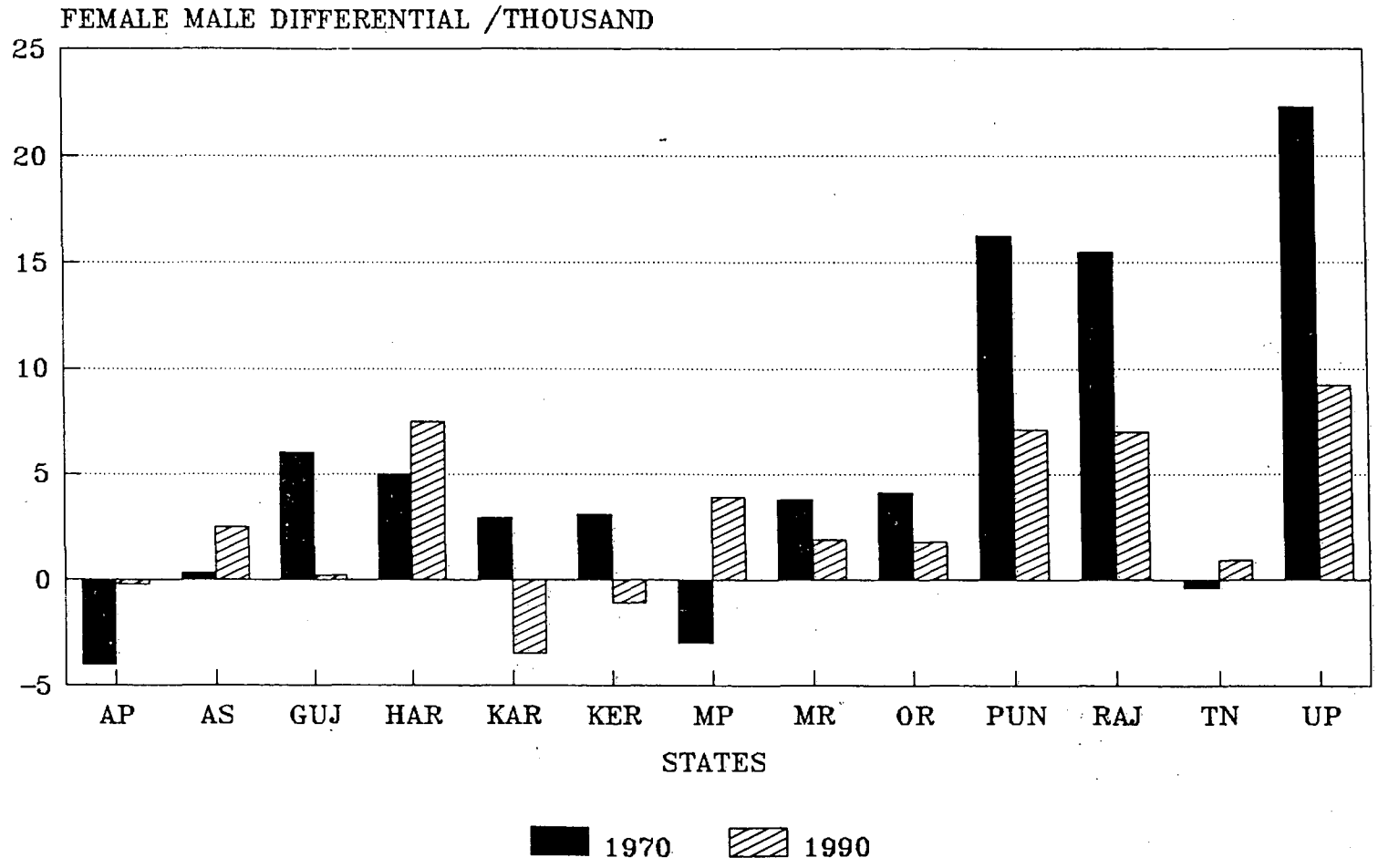


FIG:3.6

3.9 Sex Differential in Child Death Rate -

It is known that other things remaining the same, female child is better equipped in a physiological sense to survive than male. So higher mortality among rate child is normally expected.

But in India like many of the south Asian countries this is totally reversed. The gender bias against female in general and female child in particular is much stronger in India, rather son preference and the discrimination against female child is universal in India. So here our graph is based on this concept that female child death exceeds male. So the states which show female-male differential in positive, it means those states have more female child deaths. The states which show differential in negative, it means those states have more male child death rate than female.

According to the table 3.16 and graph 3.16 it can be observed that during 1970, almost all the states showed more female child death than male except the few states like Andhra Pradesh, M.P. and

Table 3.16 : Statewise Child Death Rate in Male and Female

States	1970		1990	
	M	F	M	F
Andhra Pradesh	49	45	20.8	20.6
Assam	44.7	44.4	27.3	29.8
Bihar			25.2	27.2
Gujarat	73.2	79.2	25.9	26.1
Harayana	20	25	18.3	25.8
Karnataka	20.4	23.5	22.9	19.3
Kerala	39	35.9	5.1	4
M.P.	57.6	54.8	37.4	41.5
Maharashtra	36.9	40.7	15.6	17.5
Orissa	56.5	52.4	35	36.8
Punjab	31.3	47.6	14.9	22
Rajasthan	52.8	68.3	26.2	33.2
Tamil Nadu	47.1	46.7	16.6	17.5
U.P.	67.2	89.5	32.2	41.4
W. Bengal	--	--	19.6	19.8

Tamil Nadu. In the last two states the differential was negligible. In the rest of the states the differential was remarkable. According to the graph 3.6 this is more prominent in U.P., Punjab, Rajasthan, Gujarat and Haryana. The differential found in the states of Karnataka, Kerala, and Assam was marginal.

For 1990 the observation says that only the differential of female-male declined, but few states show less female death also, like Karnataka and Kerala. Compared to Kerala, Karnataka has more child death rate. Female child death rate is still high in all northern states like Haryana, M.P., Punjab, Rajasthan and U.P. Andhra Pradesh

showed an expected or normal feature in the absence of discriminatory practices.

The overall observations show that all northern states whether they are economically developed (Punjab and Haryana) or backward (U.P. and M.P.) have more female child death than male, in both periods of time 1970 and 1990. The same pattern can be seen in western India Rajasthan and Gujrat. Gujarat shows drastic decline in differential from 1970 to 1990. According to graph as well as the table Tamil Nadu had initially more male death, now it is shifted to more female death.

So the sex differential is there for all Indian states which was sharp in 1970 and now it is approaching the mild.

One of the studies of Sen (1986) says that it has been observed that girls between the age of 1 and 5 suffer from differences in food consumption in north India. This difference becomes sharp particularly in distress situation. There is also much evidence that the female children receive much less medical attention than the corresponding male children do. Inequalities in the distribution of food within the family fit into this general pattern of relative deprivation. The relative negligence of female children leads to growth retardation. It is such 'nutritional insult' commencing right from infancy and continued right through

all stages of development, that eventually results in a maternal health/nutritional status which harms not just the women but the succeeding generation as well (1986).

To stop this differential India needs not only to improve in health services but also develop socially.

3.10 **Conclusion** :- From the above description it is clear that India's infant mortality rate and child death rate is declining sharply but large inter-state variation is still there, like Kerala with IMR hardly 17 per thousand live births and Orissa with an IMR of 122 per thousand live births in 1990. With inter-state variation there is sharp rural-urban differential also and the same pattern is found in respect of male and females.

Both infant as well as child death rate is high mostly in northern and eastern states except Punjab and Haryana. But sex differential in child death is higher in Punjab and Haryana. The BIMARU states (Bihar, Madhya Pradesh, Rajasthan, and U.P.) show high rate of infant mortality and child death. In both discussion we found out that there is almost a line of demarcation between south and North India in spatial analysis. Northern states with low level of socio-economic development, low level of literacy, lack of infrastructure facilities have high rate of infant mortality as well as child death rate. Southern states are in a

better position not only in literacy but also in health service. So they have lower infant mortality as well as child deaths. Sex differential in these two variables is much higher in the northern states including Punjab.

To improve the prevailing conditions many rural development, poverty alleviation, health programmes have been introduced in due period of time e.g. universal immunization programme, integrated child development programmes, IRDP, JRY, the programme for the development of women and children in Rural areas. The stateswise immunization programme shows the effort which each state govt. put for its development. In the period 1986-87 the state wise immunization coverage shows Maharashtra around 93 Percent of its target, Kerala 104, Punjab 56, Madhya Pradesh.35 and Bihar only 10 Percent. The coverage for all India base is only 45-60 Percent of the target which is very low (George and Nandraj : 1993)

Consequently there is need to improve the situation by direct approach like availability of health services and indirect approach through increase in literacy and poverty alleviation programmes.

CHAPTER - IV

ANALYSIS OF THE FACTORS AFFECTING MORTALITY

4.1 Introduction

Though death is a biological process, it is affected by many social, economic and infrastructural factors. Sometimes it is affected directly, sometime indirectly, sometimes it is the result of a complex system of these factors. Here we have selected some indicators and with the help of these indicators, explanation in the mortality variation in rural and urban sector are separately examined.

The selected mortality dependent variables are - (A) expectation of life at birth, (B) Infant mortality rate and child death rate.

A. Expectation of life gives a measure of the cumulative effect of mortality over the remaining life span after the attainment of age x.

B. Infant mortality rate and child - In India child death rate accords for shares 47 percent of total deaths, that is almost half of the total deaths, so it becomes necessary to emphasize on child death rate while discussing the mortality pattern in India. Infant mortality accounts 30 percent of all deaths, so not only child death rate but infant mortality rate also have to be studied separately to know the nature of the mortality pattern. To explain these dependent variables some explanatory variables have been selected:

1) Economic variables

(a) Percent population below poverty line

(b) Female work participation

2) Socio-cultural variables

(c) Female literacy

(d) Mean age at marriage

3) Infrastructural variables

(e) availability of safe drinking water

(f) Health services: Hospital bed and population ratio

(A) **Percent Population below poverty line:** India is economically very backward . Here poverty is very deep rooted and it affects every way of our life. So we look at poverty as one of our explanatory variables, so with that we try to explain upto what limit, it is explaining variation in our dependent variables.

Number of persons below poverty line on per 100 of population is called Percentage of population below poverty line.

(B) **Female Work Participation Rate:** It is said that female work participation improves the relative survivalship, especially that of children through increase in income. But it is difficult to predict whether the effect of female work participation is positive or negative. There are two important effects: (1) Involvement in gainful employment has

many positive effects. (2) Secondly, 'the double burden' of household and outside work can impair women's ability to ensure good health of their children. So in the analysis it would be seen whether it has any positive or negative effect.

Female work participation rate is the number of female main worker per hundred population of female sex

(C) **Female literacy rate:** Female literacy is found to have a negative and statistically significant impact on child mortality as also on life expectancy at birth literacy given her power to determine the family size. It makes her more aware about family health. She gets more exposure to the world. There is a large effect of female literacy on female under five mortality. So the effect of female literacy is quite large for greater than overall literacy and male literacy.

Female literacy rate is the number of female literate per hundred population of female excluding the age group 0-4 in 1971 and age group 0-6 in 1991.

(D) **Mean Age at Marriage:** In India mean age at marriage is very low. This early marriage contributes significantly both to maternal mortality and infant mortality. It is obvious that the health of infants is greatly affected by their mother's age when they are born. So in explaining the

factors responsible for mortality mean age at marriage may be one of the explanatory variables.

Mean age at marriage is a measure of the mean age at first marriage derived from a set of proportions of people single at different ages or in different age groups, usually calculated separately for males and females.

(E) **Availability of safe drinking water:** Infrastructural factors like Electricity, sanitation and safe drinking water affect human survival ship. It is one of the very important variable which affect the mortality. It helps to prevent diseases, which is one of the major reason for children's death. The literature survey provides us enough evidence that with availability of safe drinking water child deaths can be reduced. In a way, it affects on life expectancy also.

The number of sources of safe drinking water available on 100 household.

(F) **Hospital bed and population ratio:** It affects directly the health status of the society or a population. The ratio of availability of hospital bed on population show whether the proportion is appropriate for the survival of that population. If the ratio is high, it means the area is well equipped with preventive and curative measures or vice-versa.

$$\text{Hospital bed and population ratio} = \frac{\text{No. of hospital of that state}}{\text{Total population of that State}} \times 10{,}000$$

Methodology :

Stepwise Regression - The stepwise regression analysis is applied to understood the rate of explanatory variables and the dependent variables. The variables are given under:

(i) Dependent variables:

y_1 = Expectation of life at birth
y_2 = Infant mortality rate
y_3 = Child death rate

(ii) Independent variables:

x_1 = Female literacy
x_2 = Female work participation
x_3 = Percentage of population below poverty line
x_4 & x_7 = Safe drinking water
x_5 = Mean age at marriage
x_6 = Hospital bed and population ratio
x_8 = Source of water other than Tap/Tubewell/well

Limitation of Data

Our study is based on secondary data that is one of the most important limitation.

The study show the comparison between two time period, like 1970 and 1990. Through the analysis, it has to determine, which explanatory variable explains them most. But for both period, although common explanatory variables are there, there is little changes in few variables. Like for the period 1970, female mean age at marriage has been

taken and for 1990, it has been taken for the total person because of unavailability of data separately for female.

The concept of safe drinking water had not been introduced in 1970, so we take tap, tubewell and well water as safe drinking water. Sources other than this are not called safe drinking water. This data has been taken from the NSS. For 1990, census data has been available for safe drinking water.

Data for the percent population below poverty line has not been available for the exact year 1970 and 1990. so for the period 1970, the data of 1972-73 and for 1990, the data of 1987-88 has been taken into account. For the other explanatory variables (like female literacy) the data of 1971 census and 1991 census has been taken into consideration.

Our dependent variable infant mortality rate and child death rate have been taken from sample Registration System. Even this system is subject to three types of error (i) sample error, (ii) non-sampling error, (iii) matching error (Padmanabha : 1984).

Hypotheses to prove:

1. Life expectancy at birth is directly related with female literacy.

2. Infant mortality rate and child death rate are inversely related with female education.
3. Female work participation is directly related with life expectancy and inversely related with infant mortality rate and child death rate.
4. Poverty is directly related with infant mortality rate and child death rate and inversely related with life expectancy.
5. Female Mean age at marriage is directly related with life expectancy and inversely with infant mortality rate and child deaths rate.
6. Safe drinking water is positively related with life expectancy and negatively with infant mortality rate and child death rate.
7. Health service that is hospital bed/population ratio is negatively related with child death rate and infant mortality rate and positively with life expectancy.

The above mentioned hypotheses have to be proved in following analysis.

To bring out the degrees and direction of association between dependent variables and independent variables correlation matrix and stepwise regression has been shown here.

In the stepwise regression table

ß = Regression coefficient

SEß = Standard error of ß

t = the probability of deviation of ß value under the null hypothesis

R^2 = Coefficient of determination

↑R = increment in R^2

R^{-2} = Adjusted coefficient of determination

F = F ratio

4.2 Step Wise Regression for the Period 1970

Table 4.1: Correlation Matrix of Life Expectancy with Selected Explanatory variables, 1970 (Rural)

y_1	x_1	x_2	x_3	x_5	x_4	x_7	x_8	x_6
	.676*	-.371	-.450	-.127	-.000	-.248	.234	.532*
		-.218	.150	.438	.122	.000	-.040	.859**
			.562	.227	.331	.512	-.591	-.057
				.720**	-.079	.465	-.413	.340
					.047	-.054	.035	.379
						.006	-.332	.043
							-.945**	.290
								-.287

** 1% level of significance
* 5% level of significance

4.2
Table: Results of stepwise regression analysis

Step I	ß	SEß	t	R^2	$\uparrow R^2$	R	F
x_1	.277	.091	.011	.456	--	.407	9.239*
Step II							
x_1	.312	.063	.0006**	.766	.31	.720	16.445**
x_3	-.175	.048	.0045**				
Step III							
x_1	.201	.128	.150	.790	.024	.720	11.294**
x_3	-.197	.052	.004**				
x_6	2.397	2.399	.343				

** 1% level of significance

* 5% level of significance

The table 4.1 shows the correlation matrix of dependent variable (y_1) and explanatory variables (x_1, x_2, x_3, x_5, x_4, x_7, x_8 and x_6) Life expectancy show significant and positive relation with female literacy (x_1) and hospital bed and population ratio (x_6) at 5 percent level of significance. Explanatory variables female mean age at marriage (x_5) and poverty (x_3) are significantly related at 1 percent level. Even female work participation (x_2) shows highly significant relationship with health service.

The result of stepwise regression Table 4.2 shows female literacy as the most important variable which enters in the first step. It explains 45 percent of variation with F value 9.23 which is significant at 5 percent level. The relationship of female literacy (x_1) and life expectancy (y_1) is positive and significant at 5 percent level. Poverty enters in step II as the second important variable with F value 16.44 which is significant at 1 percent level. It explains 76 percent of variation. The increase in R^2 is 31 percent. Third step has been taken as optimal fit because after that step R^2 has started declining. In this step hospital bed and population ratio emerges as the third important variable. All three variables explain 79 percent of variation with F value 11.294 and 2.4 percent increment in R^2. The F value is significant at 1 percent level. In

this step the relationship of poverty with life expectancy is highly significant at 1 percent level otherwise rest variables show in significant relationship. Poverty (x_3)) and life expectancy (y_1) shows negative relationship with regression coefficient value .197. This statement proves the hypothesis that poverty is negatively related with life expectancy.

The relationship of infant mortality the with female literacy and hospital bed and population ratio is negative and significant. Its relationship with all other variables is insignificant. Independent variable female literacy (x_1) and hospital bed and population ratio (x_6) shows highly significant relationship (see the table 4.3).

The Table 4.4 show the result of stepwise regression. In the first step female literacy (x_1) enters as the most important variable which explain 45.5 percent of variation with F value 9.183 which is significant at 5 percent level. In second step female mean age at marriage (x_5) emerges as the second important variable which with female literacy x_1, explains 70 percent of variation. The $\uparrow R^2$ is 25.3 percent. The F value of second step is 12.172 which is significant at 1 percent level. Safe drinking water enters in the third step as the third important variable which together with the other two variables, explain 76 percent of variation.

In the fourth step female work participation (x_2) enters with F value 7.72 which is significant at 1 percent level. Fifth step has been taken as the optimal fit. In this step all five variables explain 88.9 percent of variation. The $\uparrow R^2$ is 9.5 percent. Its F value is 11.300 at 1 percent level of significance. Female literacy shows negative and highly significant relation with infant mortality. Its regression coefficient value is 2.721. This relationship proves the hypothesis that female literacy is negatively related with infant mortality rate. Female work participation (x_2) is also negatively related with infant mortality at 1 percent level of significance. Its regression coefficient value is 1.290. Female mean age at marriage (x_5) is positively related with infant mortality at 1 percent significance level. This result contradicts the hypothesis.

Sources of drinking water like ponds/river/tank is negatively related with infant mortality rate. This is again not true because water of ponds/rivers/tanks are called unsafe. So from the very common sense it can be said that these sources of water are directly related to infant mortality instead of what the result is showing.

Table 4.3 : Correlation Matrix of Infant Mortality Rate with Selected explanatory variables, 1970 (Rural)

y_2	x_1	x_2	x_3	x_5	x_4	x_7	x_8	x_6
1	-.675*	.263	.303	.158	.143	.093	-.135	-.603*
		-.218	.150	.438	.122.	.000	-.040	.859**
			.562*	.227	.331	.512*	-.591*	-.057
				.720	-.079	.465	-.413	.340
					.047	-.054	-.035	.379
						.006	-.332	.043
							-.945**	.290
								-.287

** 1% level of significance

* 5% level of significance

Table 4.4 : Results of stepwise regression analysis

Step I	B	SEB	t	R^2	$\uparrow R^2$	$\bar{R}^2$	F
x_1	-1.541	.508	.0114*	.455	--	.405	9.183*
Step II							
x_1	-2.101	.433	.0007**	.708	.253	.650	12.172**
x_5	3.582	1.213	.0145*				
Step III							
x_1	-2.168	.415	.0006	.762	.054	.682	9.615**
x_5	3.595	1.156	.0125				
x_4	1.328	.934	.189				
Step IV							
x_1	-2.384	.453	.0008	.794	.032	.691	7.720**
x_5	4.149	1.243	.010				
x_6	1.777	1.006	.115				
x_2	-.528	.473	.296				
Step V							
x_1	-2.721	.380	.0002**	.889	.095	.811	11.300**
x_5	5.117	1.049	.0018**				
x_6	1.616	.790	.0800				
x_2	-1.290	.482	.0319**				
x_8	-.796	.323	.0433**				

** 1% level of significance

* 5% level of significance

Table 4.5: Correlation Matrix Child Death Rate with Selected Explanatory Variables, 1970 Rural

y_3	x_1	x_2	x_3	x_5	x_4	x_7	x_8	x_6
1	-.277	.041	.306	.218	.247	.194	-.263	-.187
		-.218	.150	.438	.122	.000	-.040	.859**
			.562*	.227	.331	.512*	-.591*	-.057
				.720**	-.079	.465	-.413	.340
					.047	-.054	.035	.379
						.006	-.332	.043
							-.945*	.290
								.287
								1

Table 4.6 : Results of stepwise regression analysis

Step I	B	SEB	t	R^2	$\uparrow R^2$	R^2	F
x_3	.272	.255	.309	.093	--	.011	1.137
Step II							
x_3	.316	.254	.242	.200	.107	.040	1.252
x_1	-.388	.336	.275				
Step III							
x_3	.345	.251	.203	.302	.102	.069	1.299
x_1	-.440	.334	.220				
x_4	.949	.827	.281				
Step IV							
x_3	.857	.276	.0146*	.625	.323	.437	3.336
x_1	-.822	.297	.0246*				
x_4	2.058	.769	.0282*				
x_2	-1.118	.425	.0340*				
Step V							
x_3	.818	.274	.020*	.681	.056	.454	3.00
x_1	-.858	.295	.022*				
x_4	1.901	.771	.0431*				
x_2	-1.302	.450	.023*				
x_8	-.294	.264	.3010				

** 1% level of significance

* 5% level of significance

The correlation Matrix shows that child death rate (y_3) is negatively related with female literacy (x_1), other

sources of drinking water and hospital bed and population ratio. With the rest of the explanatory variables, it shows positive relationship but none of them are significant (see the table 4.5).

In the stepwise regression, poverty comes in the first step and shows positive relationship with child death rate (see the table 4.6). Its F value is 1.137 but insignificant and it explains 9.3 percent of the variation. Female literacy show negative relationship as it enters in the second step. Both of them explain 20 percent of the variation. The increment in R2 is 10.7 percent. In the third step safe drinking water enters and it explains 30 percent of the variation.

The Fourth step includes female work participation rate (x_2) and explain 62.5 percent of the variation. The Fifth step has been taken as the optimal fit. It explains 68 percent of the variation. The $\uparrow R^2$ is 5.6 percent. Its F value is insignificant. Poverty (x_3) show direct relationship with child death rate at 5 percent level of significance. Its ß value is .858. Even female work

participation (x_2) is negatively related with child death rate, which is significant at 5 percent level and ß value is 1.302. Above These three relationships prove the hypothesis but the other two relationships of safe drinking water and other sources of water with child death rate contradict the hypothesis. Neither is safe drinking water (Tap) directly related with child death rate nor is the other source of drinking water.

Table 4.7 : Correlation Matrix of Life Expectancy with Selected Explanatory Variables, 1970 (Urban)

y_1	x_1	x_2	x_3	x_5	x_4	x_7	x_8	x_6
1	.394	.373	-.274	-.145	.038	-.040	.052	.190
	1	.305	.021	.253	-.330	.328	.027	.314
		1	.618	.396	.340	.361	-.712	.094
			1	.735**	.085	.545	-.622	.173
				1	-.047	.375	-.266	-.065
					1	-.518	-.538	-.587
						1	-.442	.701*
							1	.068
								1

* 5 percent level of significance

** 1 percent level of significance

Table 4.8 : Results of stepwise regression analysis

Step I	B	SEB	t	R^2	$\uparrow R^2$	R^2	F
x_1	.158	.111	.182	.155	--	.078	2.02
Step II							
x_1	.190	.113	.125	.248	.093	.098	1.65
x_5	-.215	.193	.292				
Step III							
x_1	.151	.109	.201	.404	.156	.205	2.035
x_5	-.318	.193	.134				
x_2	.492	.321	.159				
Step IV							
x_1	.062	.109	.586	.575	.171	.363	2.713
x_5	.024	.258	.926				
x_2	.900	.366	.039*				
x_3	-.183	.102	.109				
Step V							
x_1	-.017	.128	.892	.643	.068	.389	2.53
x_5	.200	.294	.518				
x_2	1.041	.378	.028*				
x_3	-.256	.118	.066				
x_6	.152	.131	.285				
Step VI							
x_1	-6.355	.124	.961	.711	.068	.422	2.466
x_5	.262	.291	.402				
x_2	1.063	.368	.027*				
x_3	-.227	.117	.101				
x_6	.293	.174	.144				
x_7	-.116	.098	.280				

* 5% percent level of significance
** 1% percent level of significance

The table 4.7 shows that life expectancy (y_1) is positively related with female literacy (x_1), female work participation (x_2), hospital bed and population ratio. It is also positively related with drinking water facilities like tap water. It is negatively related with poverty, female mean age at marriage and drinking water facilities like tube well and well.

In the regression analysis female literacy enter in step one as the most important variable which explains 15 percent of the variation with F value 2.02 which is not significant (see the table 4.8). In second step female mean age at marriage enters in the equation as the second important variable. Both of them explain 24 percent of variation with F value 1.65 which is non-significant. The increase in $\uparrow R^2$ is 9.3 percent. Female work participation enters in the third step, which explains altogether 40 percent of the variation. The marginal increase in R^2 is 15.6 percent. In the fourth step poverty enters in the equation as the fourth most important variable. The R^2 value is 57 percent and the marginal increase is 17.1 percent. In the fifth step hospital bed and population ratio enters in the equation, which with other four variables explain 64 percent of the variation. After the

sixth step the value of R^2 starts declining. So this step has been taken as the optimal fit, where the six variables together explain 71 percent of the variation. The increase in $\uparrow R^2$ is 6.8 percent. F values of all steps are insignificant. In all the relationships of the sixth step only the relation of life expectancy with female work participation is significant at 5 percent level. It is positively related with regression coefficient value 1.063. This relationship proves the hypothesis that female work participation has direct and positive relationship with life expectancy.

Table 4.9 : Correlation Matrix of Infant Mortality Rate with Selected Explanatory Variables, 1970 (Urban)

y_2	x_1	x_2	x_3	x_5	x_4	x_7	x_8	x_6
1	.113	.102	.057	.118	-.088	-.041	.128	-.229
	1	.305	.021	.253	-.330	.328	.027	.314
		1	.618	.396	.340	.361	-.712	.094
			1	.735**	.085	.545	-.622	.173
				1	-.097	.375	-.266	-.065
					1	-.518	-.538	-.587
						1	-.442	.701
							1	.068
								1

Table 4.10 : Results of stepwise regression analysis

Step I	B	SEB	t	R^2	$\uparrow R^2$	R^{-2}	F
x_6	-.606	.776	.451	.052	--	-.033	.609
Step II							
x_6	-1.132	.965	.267	.127	.075	-.046	.732
x_4	-.445	.479	.374				
Step III							
x_6	-1.537	1.045	.175	.215	.088	-.045	.824
x_4	-.716	.550	.225				
x_2	2.187	2.178	.341				
Step IV							
x_6	-1.742	1.196	.183	.233	.018	.150	.608
x_4	-.894	.649	.229				
x_2	2.860	2.772	.332				
x_5	-.642	1.499	.679				
Step V							
x_6	-2.014	1.422	.199	.251	.018	-.282	.470
x_4	-.954	.735	.235				
x_2	2.535	3.030	.430				
x_5	-1.387	2.390	.579				
x_3	.347	.835	.690				
Step VI							
x_6	-2.144	1.583	.224	.263	.012	-.473	.357
x_4	-.908	.802	.300				
x_2	1.897	3.861	.640				
x_5	-1.783	2.871	.557				
x_3	.528	1.073	.640				
x_1	.355	1.162	.770				
Step VII							
x_6	-1.987	1.886	.340	.269	.033	-.753	.263
x_4	-.997	.975	.353				
x_2	2.148	4.384	.644				
x_5	-1.792	3.132	.592				
x_3	.607	1.232	.643				
x_1	.353	1.268	.791				
x_7	-.225	1.047	.845				

* 5% percent level of significance

** 1% percent level of significance

The Table 4.9 shows that infant mortality rate (y_2) is negatively related with safe drinking water and hospital bed and population ratio. The relationship is not significant at 1 percent or 5 percent level.

The table 4.10 shows the result of stepwise regression analysis. For the analysis of infant mortality rate health services enters in first step as the most important variable which explain 52 percent of the variation with F value .609. Safe drinking water (x_4) (tap) enters in the second step. The increase in $\uparrow R^2$ is 7.5 percent. Female work participation (x_2) emerges as the third important variable which altogether explains 21.5 percent of the variation. In the fourth step, female mean age at marriage (x_5) and in the fifth step, poverty (x_3) emerge as the important variables. The sixth important variable is female literacy (x_1). The seventh step emerges as the optimal fit but like other steps even in this step F value is insignificant. Although it explains 33 percent of the total variation, none of the relationship of this step are significant. So it does not explain any relationship.

Table 4.11 : Correlation Matrix of Child Death Rate With Selected Explanatory Variables, 1970 (Urban)

y_3	x_1	x_2	x_3	x_5	x_4	x_7	x_8	x_6
1	.402	.433	.117	.334	.027	.184	-.211	-.022
	1	.305	.021	.253	-.330	.328	.027	.314
		1	.618*	.396	.340	.361	-.712**	.094
			1	.735**	.085	.545*	-.622	.173
				1	-.047	.375	-.266	-.065
					1	-.578	-.538*	-.587
						1	-.442	.701**
							1	.068
								1

Table 4.12 : Results of stepwise regression analysis

Step I	β	SEB	t	R^2	$\uparrow R^2$	R^{-2}	F
x_2	1.389	.873	.139	.187	--	.113	2.53
Step II							
x_2	1.097	.913	.257	.267	.08	.120	1.824
x_1	.343	.328	.320				

* 5% percent level of significance

** 1% percent level of significance

The result shows (Table 4.11) child death rate (y_3) is positively related with all the explanatory variables (x_1, x_2, x_3, x_5, x_4, x_7) except hospital bed ratio and drinking

water (sources like tank/pond and rivers). The relationship of dependent variable (y_3) and independent variables are not significant.

The table 4.12 of stepwise regression shows female work participation as the most important variable which comes in the first step and it explains 18 percent of the variation with F value 2.53 which is not significant. Female literacy (x_1) emerges in the second step as the 2nd most important variable, which with x_2 explains 26 percent of the variation. The second step has been taken as the optimal fit. The increment in R^2 is 8 percent and its F value is 1.824 which is insignificant. In the second step the relationship of dependent variable (y_3) with independent variables (x_2 and x_1) does not show any significant relationship. So non of the hypothesis related to child death rate can be proved here.

4.3 **Stepwise Regression for the Period 1990**

The correlation between dependent variables y, (like expectancy) and independent variables X_{11} X2 .... X_6 has been shown in Table 4.13 for rural sector in 1990. Life expectancy is positively correlated with female literacy (x_1), female work participation (x_2) mean age at marriage (x_5) and hospital bed and population ratio (x_6). It is negatively related with poverty (x_3) and safe drinking water

(x_4). Life expectancy is significantly correlated with female literacy, mean age at marriage and hospital bed and population ratio.

In independent variables mean age at marriage (x_5) is highly correlated with female work participation (x_2). Female work participation (x_2) is also highly correlated with hospital bed and population ratio.

Table 4.14 shows that female literacy (x_1) comes as the most important variable which explains 69 percent of the variation

Table 4.13 : Correlation matrix of life expectancy with Selected Explanatory Variables, 1990 (Rural)

y_1	x_1	x_2	x_3	x_4	x_5	x_6
1	.830**	.126	-.407	-.084	.568*	.686
	1	-.028	-.391	-.353	.857**	.828**
		1	.540	-.200	-.303	-.086
				-.146	-.524*	-.288
				1	-.237	-.595*
						.701**
						1

Table 4.14 : Results of stepwise regression analysis

Step I	B	SEB	t	R^2	$\uparrow R^2$	R^{-2}	F
x_1	.247	.0461	.0001**	.689	--	.665	28.285**
Step II							
x_1	.386	.080	.0004**	.767	.078	.728	19.78**
x_5	-2.235	1.114	.0679				
Step III							
x_1	.434	.073	.0001**	.837	.070	.792	18.83**
x_5	-2.528	.483	.026*				
x_4	.078	.036	.052				
Step IV							
x_1	.360	.085	.0018**	.867	.030	.814	16.380**
x_5	-2.61	.931	.0185*				
x_4	.115	.041	.0204*				
x_6	.420	.276	.159				
Step V							
x_1	.312	.100	.012*	.879	.012	.812	13.10**
x_5	-2.060	1.11	.096				
x_4	.129	.044	.018*				
x_6	.508	.294	.118				
x_2	.066	.071	.376				

* 5% percent level of significance

** 1% percent level of significance

with the F value 28.825 which is significant at 1 percent level. In the second stepm mean age at marriage (x_5) emerges as the second important variable which explains 76 percent of the variation with F value 19.78 which is significant at 10 percent level. The increase in R^2 is 7.8 percent.

In the third step, safe drinking water facilities comes as the third most important variable which with the rest of the two variables explain 83 percent of the variation, with F value 18.83 which is significant at 1 percent level. Here the 4th step has been taken as optimal fit. The increment in $\uparrow R^2$ in fourth step is 7 percent. In the fourth step hospital bed and population ratio becomes the fourth important variable, which with all the other explains 86 percent of variation with F value 16.38 which is significant at 1 percent level.

In the fourth step female literacy (x_1) show positive and 1 percent significant relationship with life expectancy (y_1) with regression coefficient value .360. This statement accepts our hypothesis. The result shows mean age at marriage (x_5) is negatively related with life expectancy which is significant at 5 percent level. This relationship contradicts the hypothesis. It could be accepted only when mean age at marriage would be more than 28 or 29 years and there is possibility of maternal death. But in India mean age at marriage is still 20 years which is very low. So with the increase of mean age at marriage, life expectancy will increase not decrease. The relationship which the result show does not approve the hypothesis.

Safe drinking water is positively related with life expectancy at 5 percent level of significance with regression coefficient value .115. This relationship accepts the hypothesis.

Table 4.15: Correlation Matrix of Infant Mortality Rate with Selected Exoplanatory Variables, 1990 (Rural)

y_2	x_1	x_2	x_3	x_4	x_5	x_6
1	-.768**	-.009	.408	.142	-.539	-.705**
	1	-.028	-.391	-.353	.857**	.828**
		1	.540	-.200	-.303	-.086
			1	-.196	-.524	-.288
				1	-.237	-.595
					1	.701
						1

Table 4.15 shows the correlation matrix of infant mortality rate and its independent variables.

Infant mortality rate (y_2) is negatively related with female literacy (x_1), female work participation (x_2), mean age at marriage (x_5) and hospital bed and population ratio (x_6). It is positively related with poverty (x_3) and safe

Table 4.16 : Result of stepwise regression analysis

Step I	B	SEB	t	R^2	$\uparrow R^2$	R^{-2}	F
x_1	-1.143	.264	.0008**	.589	--	.55	18.702**
Step II							
x_1	-1.718	.498	.004*	.640	.051	.584	10.846**
x_5	9.26	6.874	.202				
Step III							
x_1	-1.806	.484	.003**	.695	.055	.612	8.39**
x_5	13.217	7.233	.094				
x_3	.580	.422	.197				
Step IV							
x_1	-1.512	.623	.035*	.713	.018	.598	6.213**
x_5	13.208	7.369	.103				
x_3	.60	.431	.194				
x_6	-1.287	1.66	.456				

* 5% percent level of significance

** 1% percent level of significance

drinking water (x_4). Infant mortality is significantly related with female literacy (x_1) and hospital bed and population ratio at 1 percent level of significance. Independent variable female work participation (x_2) is highly correlated with mean age at marriage (x_5) and hospital bed and population ratio (x_6).

The table 4.16 shows the result of stepwise regression. In step one female literacy (x_1) comes as the most important variable which explains 58 percent of the variation with F

value 18.702 which is significant at 1 percent level. In the second step, mean age at marriage (x_5) emerges as the second important variable with female literacy (x_1). It explains 64 percent of the variation with its F value 10.846 which is significant at 1 percent level. The increase in R^2 is 5.1 percent. In the third step poverty emerges as the third most important variable which all together explains 69 percent of variation. It has F value 8.39 with 1 percent of significance. The increase in R^2 value is 5.5 percent. Since in the fourth step the increase in R^2 is declining the third step has been taken as the optimal fit. Here the infant mortality rated (y_1) shows negative relation with 1.86 regression coefficient value which is significant at 5 percent level. This relationship proves our hypothesis that female literacy (x_1) is inversely related with infant mortality rate (y_1). Rest of the relationship is not significant.

Table 4.17 : Correlation matrix of Child Death Rate 1990 (Rural)

y_3	x_1	x_2	x_3	x_4	x_5	x_6
1	-.566	.028	.110	-.040	-.347	-.521**
	1	-.028	-.391	-.353	.857**	-.828**
		1	.540	-.200	-.303	-.086
			1	-.196	-.524	-.288
				1	-.237	-.595
					1	.701
						1

The Table 4.17 show the correlation matrix of dependent variable child mortality (y_3) and independent variables. It is negatively related with female literacy (x_1), safe drinking water (x_4), mean age at marriage (x_5) and hospital bed and population ratio. It is positively related with

Table 4.18 : Results of stepwise regression analysis child mortality (Rural)

Step I	B	SEB	t	R^2	$\uparrow R^2$	R^{-2}	F
x_1	-.385	.155	.028*	.319	--	.267	6.115*
Step II							
x_1	-.688	.298	.039*	.391	.072	.289	3.85*
x_5	4.88	4.117	.258				
Step III							
x_1	-.812	.302	.021*	.478	.087	.336	3.368
x_5	5.63	4.017	.188				
x_4	-.200	.147	.201				
Step IV							
x_1	-.503	.348	.179	.579	.10	.410	3.43*
x_5	4.50	4.10	.300				
x_4	-.42	.187	.048				
x_6	-1.740	1.128	.154				
Step V							
x_1	-.458	.352	.225	.618	.039	.407	2.92
x_5	4.50	4.10	.300				
x_4	-.42	.187	.048				
x_6	-1.96	1.154	.123				
x_3	-.25	.262	.357				

female work participation (x_2) and poverty (x_3). The table 4.18 shows that female literacy (x_1) emerges as the most important variable in step one which explains 31 percent of the variation with F value 6.11 which is significant at 5 percent level. In the second step, mean age at marriage (x_5) emerges as the second important variable which explains 39 percent of the variation. The marginal increase in R^2 is 7.2 percent. In the third step safe drinking water comes up as the third important variable which explains 47 percent of variation. The increase in R^2 is 8.7 percent. The fourth step has been taken as the optimal fit where all four variables explain 57.9 percent of the variation with F value 3.43 which is significant at 5 percent level. But here values of ß are insignificant. In the first second and third steps, female literacy shows negative correlation with child death rate at 5 percent level of significance. But in the fourth step the obtained regression coefficient values are insignificant.

Table 4.19 : Correlation Matrix of Life Expectancy, 1990 (Urban)

y_1	x_1	x_2	x_3	x_4	x_5	x_6
1	.475	.255	-.003	-.212	.398	.198
	1	.222	-.395	-.597	.780**	.709**
		1	.398	-.274	-.155	-.203
			1	.240	-.472	-.189
				1	-.475	-.740**
					1	.779**
						1

Table 4.20 : Results of stepwise regression analysis

Step I	B	SEB	t	R^2	TR^2	R^2	F
x_1	.125	.064	.073	.225	--	.166	3.793
Step II							
x_1	.148	.071	.058*	.266	.041	.144	2.17
x_3	.085	.105	.431				
Step III							
x_1	.250	.110	.045*	.349	.083	.171	1.96
x_3	.189	.135	.190				
x_4	.083	.070	.261				
Step IV							
x_1	.207	.125	.128	.386	.037	.140	1.573
x_3	.234	.149	.148				
x_4	.099	.674	.212				
x_5	.986	1.268	.455				

* 5% percent level of significance
** 1% percent level of significance

Table 4.19 shows the correlation matrix of life expectancy (y_1) in urban sector and its independent variables. The relationship as the table shows are insignificant.

The table 4.20 shows that female literacy (x_1) is the most important variable which comes in step one. It explains 22.5 percent of the variation which F value 3.79 which is insignificant. In the second step poverty (x_3) comes as the second important variable explaining 26.6 percent of the variation with insignificant F value. The increase in R^2 is 4 percent. In the third step safe drinking water facilities (x_4) comes as the third most important variable with F value 1.96. It explains 34.9 percent of the variation. R^2 starts declining after this step, so the third step has been taken as the optimal fit.

Here female literacy (x_1) is positively related with life expectancy at 5 percent level of significance with regression coefficient value 250. It approves our hypothesis that with the increase of female literacy (x_1) there is increase in life expectancy also.

Table 4.21 : Correlation Matrix of Infant mortality Rate with Selected explanatory Varibles Urban

y_1	x_1	x_2	x_3	x_4	x_5	x_6
1	-.849	-.227	.178	.551	-.646	-.596
	1	.222	-.395	-.597	.780	.709
		1	.398	-.274	-.155	-.203
				-.240	-.472	-.189
				1	-.475	-.740
					1	.779
						1

Table 4.22: Result of stepwise regression analysis

Step I	B	SEB	t	R^2	$\uparrow R^2$	R^2	F
x_1	-1.177	.202	.0001**	.721	--	.699	33.664**
Step II							
x_1	-1.279	.217	.0001**	.750	.029	.709	18.08**
x_3	-.382	.321	.256				
Step III							
x_1	-1.415	.355	.002**	.756	.006	.689	11.379**
x_3	-.521	.434	.255				
x_4	-.111	.226	.630				

* 5% percent level of significance

** 1% percent level of significance

The correlation matrix (Table 4.21) of infant mortality (y_2) in urban sector show negative relation with female literacy (x_1), female work participation (x_2), mean age at marriage (x_5). It is positively related with poverty and safe drinking water facilities. Safe drinking water x_1, x_4, x_5 and x_6 show highly significant relationships.

The table 4.22 shows female literacy (x_1) as the most important variable that comes in step I and explains 72 percent of variation with F value 33.66 which is significant at 1 percent level. In second step poverty emerges as the second important variable. Both of these variables explain 75 percent of variation with F value 18.08. It is significant at 1 percent level. The increase in R^2 is 2.9 percent. The second step has been taken as the optimal fit. Here female literacy (x_1) shows negative relation at 1 percent level with regression coefficient value 1.279. The statement accepts our hypothesis that with the increase in literacy, there is decline in infant mortality rate.

Table 4.23 : Correlation Matrix Child Death Rate with Selecte Explanatory Variables, 1990 (Urban)

y_3	x_1	x_2	x_3	x_4	x_5	x_6
1	-.814**	-.400	.122	.524	-.503	-.434
	1	.222	-.395	-.597	.786**	.709
		1	.398	-.274	-.155	-.203
			1	-.240	-.472	-.189
				1	-.475	-.740**
					1	.779**
						1

Table 4.24 : Result of stepwise regression

Step I	B	SEB	t	R^2	$\uparrow R^2$	R^2	F
x_1	-.377	.074	.0002**	.663	--	.637	25.60**
Step II							
x_1	-.354	.073	.0004**	.713	.05	.666	14.960**
x_2	-.316	.217	.171				
Step III							
x_1	-.388	.089	.001*	.726	.013	.652	9.750**
x_2	-.213	.264	.436				
x_3	-.101	.139	.485				
Step IV							
x_1	-.591	.172	.066**	.769	.043	.677	8.343**
x_2	.146	.366	.698				
x_3	-.235	.167	.188				
x_6	.231	.169	.203				
Step V							
x_1	-.586	.181	.010	.772	.003	.645	6.105p**
x_2	.192	.408	.647				
x_3	-.210	.190	.299				
x_6	.281	.232	.256				
x_4	.036	.109	.743				

* 5% percent level of significance

** 1% percent level of significance

The correlation matrix of child mortality show negative relation with female literacy (x_1), female work participation (x_2), mean age at marriage (x_5)), hospital bed and population ratio (x_6) (see the table : 4.24).

The relationship which are highly significant are with x_1, x_4 and x_5. The regression result (table 4.24) show female literacy as the most important variable which emerge n step one. It explains 66.3 percent of the total variation with F value 25.60 which is significant at 1 percent level. In the second step, female work participation comes as the second most important variable which explains 71 percent of the variation with F value 14.96 at 1 percent level of significance. The increase in R^2 in the second step is just 5 percent. In the third step poverty emerges as the third important variable. All three variables explain 72 percent of the variation. The increase in R^2 is 1.3 percent.

In the fourth step hospital bed and population ratio enters in the equation. All four variables explain 76 percent of the variation with F value 8.34 which is significant at 1 percent level. This relationship accepts our hypothesis that child death rate is negatively related with female literacy.

4.4 Conclusion

Results of analysis clearly indicate that during 1970, the economic variables were quite active to affect mortality. the poverty affected infant mortality and child death rate positively and female work participation negatively.

In socio-cultural variables, only female literacy shows a significance effect on all dependent variables.

Poverty which negatively affects the life expectancy with ß value .197 does not even figure in 1990 as important variable to influence life expectancy. So in 1990, poverty does not show any relevant relationship with life expectancy.

Female work participation does not show any influence on life expectancy but it is important in the case of infant mortality rate and child death rate with ß value 1.290 in infant mortality rate and 1.302 in child death rate . In the 1990's analysis this explanatory variable does not even come in any step of regression.

So the economic variables which are important determinants in 1970 are not more important in 1990's analysis. The socio-cultural variable female literacy shows its significant role n 1970 in life expectancy, infant mortality and child death rate also.

The ß value of female literacy with life expectancy in 1970 (rural sector), is .312 which is not showing much significant relation. But in the case of 1990 (rural sector) with ß value .360 it shows highly significant relation.

During the period 1970, female literacy negatively affects infant mortality rate with ß value 2.721, in 1990 this value declines upto 1.512. Female literacy also show negative relation with child mortality with ß value .858 which declines upto .503 in the period 1990 in rural sector.

So, female literacy which is an important variable in both periods to explain mortality shows decrease in its ß value from period 1970 (rural) to 1990 (rural).

In the period of 1990, besides female literacy, safe drinking water shows significant position to explain mortality. Its ß value is 2.397.

In 1970 in urban sector female literacy does not show any impact but in 1990, it affects infant and child death rate with ß value 1.415 and .006. From the above analysis, it can be said that the economic variables which were important in 1970 are not important in 1990. The socio-cultural variable female literacy was one of the important determinant in 1970, and is also in 1990 but its ß value is declining.

During 1990 in rural sector the presence of safe drinking water shows its importance otherwise rest of the variables do not show any importance in determining the mortality. Neither mean age at marriage nor hospital-bed and population ratio explain mortality in both period.

CHAPTER - V

SUMMARY & CONCLUSION

Conclusion

The mortality pattern of a particular area is the result of social, economic and environmental factors. From earlier studies, it was found that mortality declined in developing countries just after the second world war, but in the last few decades, the decline has been quite remarkable. It is estimated that between 1960 and 1992, life expectancy at birth in developing countries increased from 46 to 63 years and infant mortality rate has declined by more than 50 percent (sen : 1995).

In India decline in mortality is a striking demographic feature. As per thousand, in early twenties it has dropped to 15 per thousand in mid seventies. The decline can be attributed largely to control of epidemics, introduction of massive health services, eradication of major epidemics and killer diseases; such as plague, cholera, smallpox and Malaria. So the decline in mortality is reflected in our increasing life expectancy. Now India's life expectancy at birth is more than doubled (60 years in 1990) than early 1920, (23 years in 1920)

To discuss the spatio-temporal pattern of mortality three indicators have been taken (1) life expectancy AT birth (2) Infant mortality (3) and child death rate(0-4 age group). Life expectancy at birth shows the quality of life

that a society gives to its people. Infant and child mortality shows the socio-economic conditions of particular society. The share of infant mortality and child death rate (0-4) in total deaths shows the level of development of any country. To discuss the trend of mortality, we have selected the above three important indicators. On the basis of literature survey, it is found that three variables - Economic, socio-cultural and Infrastructural variables are important in affecting mortality.

The regional variation is very wide in mortality pattern. Sex differential exists in India because of comparatively lower status of women. Differential is wide in areas which are also socio-economically backward.

One of the economic factors which is expected to explain more about the variation in mortality pattern is percent population below the poverty line. In India poverty is deep rooted especially in the rural sector. "A malnourished mother gives birth to low weight babies, whose basic needs of health, nutrition, physical and mental well-being due to poverty remain unfulfilled. When they reach adulthood, they become undernourished mothers, and give birth to low weight babies and the vicious circle of ill-health and poverty continues.

Another economic factor is female work-participation. The study by Krishnaji (1995) shows that, in one way it raises family income, which helps to increase the quality of life in the family but the other view is that, when females go for work, their children get- neglected and it affects their survivorship.

The socio-cultural factors which affect the mortality pattern are female mean age at marriage and female literacy. Early marriage contributed significantly both maternal and infant mortality (Khan: 1993). An Educated female can take her own decision. She is more aware of her duties. She is likely to be less dependent on her sons as a source of social status and old age security (Murthy : Guio and Dreze: 1995)

Infrastructural facilities have direct impact on mortality. e.g. safe drinking water facilities; which prevent water born diseases. So it is important not only for adults but also for the survival of infant and children. According to the study of Beenstock and sturdy (1990) with the increase of one percent in safe drinking water facilities, the relative probabilities of infant dying falls by 3 percent. They further discuss that the relative probability of infant dying because of the mother drinking unclean water was 11 Percent higher than for mothers who

drink tap water (safe drinking water). Health Infrastructural facilities are linked directly with survivalship. Access to modern medical facilities throughout a mother's pregnancy, at delivery and during infancy and childhood is considered to be particularly important in reducing mortality (Mosley : 1983). In India according to Gopalan (1985) we have not yet put on the ground a health Infrastructure which effectively reaches even 20 percent of the population. We have a number of programmes in the field of child health and nutrition but all are ad-hoc, being carried out sporadically here and there (Gopalan : 1985).

The second chapter discusses, the Spatio-temporal pattern of life expectancy. India's life expectancy compared to developed countries is still low like Japan has 78 year and China 69.8 year of life expectancy where India has only 58.4 years during 1990. But India's situation is still better than a from few of the third world countries like Afghanistan and Bangladesh where life expectancy is 46 years and 52 years in 1990.

From the beginning of the century, the life expectancy gradually increased in India except for the period 1911-21, In 1940, it was 32 years for both males and females, which in 1990 has increased and become 59.4 years for both males

and females. There is a wide regional variation among the states. We can draw a line of demarcation between south and north Indian status regarding, variation in pattern of life expectancy. All the south Indian states have higher life expectancy than national average while the north Indian states have life expectacy below the national average. In 1990 Kerala enjoyed the highest life expectancy that is more than 70 years, whereas U.P. had only 55 years. There is a wide gap between rural and urban pattern. On national level rural life expectancy was 48 years in 1990. Throughout the time period under consideration Kerala enjoyed highest life expectancy and U.P. the lowest. All the north Indian states like M.P., U.P. Orissa, Rajasthan, Assam had life expectancy below 52 years in 1970-75. In the last fifteen years Gujarat, Andhra Pradesh and Tamil Nadu have tried to increase their life expectancy and now they have more than 56 years of life expectancy in rural sector also. Urban sector showed high life expectancy than rural. In 1970, the urban national average was just 56 years while in 1986-90 it becomes 63 years. The urban regional pattern is similar to the rural pattern. The states which enjoyed high level of life expectancy in urban areas arew either socially developed (Kerala) or economically developed (Punjab and Maharashtra with high per capital Income). In the Indian

context male life expectancy exceeds female (against the expectation) In inter state variation northern and eastern states show more life expectancy in male than in females. But some of the south Indian states like Maharashtra, Kerala and Tamil Nadu show more life expectancy at birth in female than male. Theses interstate variation cannot be explained by a single cause. These variations show socio-economic and demographic characteristic as well as historical, political and cultural diversities.

Health infrastructure is not the sole agent which influences life expectancy. Level of literacy, social welfare policies, development of adequate housing, water supply and environmental hygiene etc. have no less importance than economic growth with high employment level, improved wage structure and more equitable income distribution.

Chapter III has discussed the level and trend in infant mortality rate and child death rate and its spatio temporal pattern. Compared to developed countries India's infant mortality is very high e.g. Japan has IMR of only 5 per 1000 live births in India, it is about 80 (in 1993), Korea, Sri Lanka, Malaysia and Philippines have IMR of 47 to 80 per 1000 live births. In pre-Independence period infant mortality was high. After independence, it declined

gradually from 110 to 80 per thousand live births in 1993. The inter state variation showed the maximum infant mortality rate in U.P., Orissa and M.P. during 1970, but in 1990 the highest IMR was in Orissa (112). Even now in Orissa it is 103 per thousand live births (1994). Haryana and U.P. showed increase in infant mortality rate between 1970 and 1980. Comparatively the southern states have lower infant mortality rate. Kerala has IMR only 16 per thousand live birth's in 1994. The same pattern is followed in rural and urban sector. Although 1990 data shows less gap in sex-differential in IMR, it is sharper in north India than south India. The reason for high infant mortality rate in north India is that they are socio-economically backward.

The study of child death rate in addition to IMR is needed because the causes of death of children are significantly different from those in infants. The spatio temporal pattern of child death rate shows that the states which have high IMR also have high child death rate. In India, child death (0-4) accounts for nearly 46 Percent of all deaths, while children of this age-group constitute only 15 percent of our population. To solve the major problems of IMR and child death rate many programmes have been introduced in various five year plans. For example Integrated Child Development Service Scheme, Rural Women and

Child Development Scheme etc. Beside these, mother and child care, Anti-natal care programmes, Tamil Nadu Integrated Nutrition projects have also been implemented.

The fourth chapter discusses the results relating to the relationship of the above discussed mortality indicators with a few selected explanatory variables.

As the results show, Economic variables namely, proportion of population below poverty line and female workparticipation were important which affected the mortality pattern during 1970. Poverty affects directly the IMR as well as the child death rate. It also shows negative relation with life expectancy especially in the rural sector. Female workparticipation shows its direct relation with life expectancy. It proves that with the increase of family income, there is increase in life expectancy. In IMR and child death rate, it shows negative relationship.

Of the two socio-cultural factors only female literacy showed its impact on mortality in 1970, especially in the rural sector as it is discussed in first chapter the female literacy is much more important factor in influencing mortality than general literacy. The results prove that female literacy directly affects the life expectancy and inversely the infant mortality rate and child death rate. In urban sector during 1970 only female workparticipation shows its influence.

During 1990, the urban as well as the rural sector does not show any influence of economic factors. The main determinants of mortality during this period are female literacy rate and safe drinking water facilities. In the rural sector safe drinking water affects the life expectancy but it does not show any impact in urban sector. So only female literacy rate remains one which explains mortality in 1990.

It helps us to make the statement that in 1970, both economic and socio-cultural factors actively influenced mortality but during the period of time with several poverty alleviation programmes, the effect of economic factors declined. Now in 1990, socio-cultural factors female literacy rate and safe drinking water show their impact.

From the above discussion we conclude that female literacy rate, availability of safe drinking water are the important variables which affect mortality more significantly than any other explanatory variable which we have taken.

So the government's long term programme to reduce mortality should involve all these factors. Besides that, peoples active participation is equally necessary for this:

1. There must be a well conceived, coherent national policy in this regard which will set specific goals and targets and time bound programmes for achieving them.
2. The necessary political will, material and man-power resources, administrative competence, dedication and determination to implement that policy must be moblised at all levels on a sustained and continuing basis.

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