CHAPTER I
REVIEW OF LITERATURE

1.1 OVERVIEW

Infant mortality has traditionally been viewed as an indicator of the social and economic well-being of a society. It reflects not only the magnitudes of those health problems which are directly responsible for the death of infants, such as diarrhoeal and respiratory infections and malnutrition, but the net effect of a multitude of other factors, including prenatal and postnatal care of mother and infant, and the environmental conditions to which the infant is exposed. The type and number of determinants of infant mortality are so innumerable and diverse in nature (Mahadevan, 1986). The wide spectra of determinants on mortality are: ecological, familial, marital, parental, conception and pregnancy, perinatal norms on child care and socialization, morbidity pattern and genetic factors, calamity/accident and war, interventions, and polity and policy (Mahadevan, 1986).

A review of the various variables is made here to give a holistic picture of the existing knowledge on determinants of infant mortality and to indicate the gaps in the existing knowledge.

1.2. ECOLOGICAL VARIABLES

The habitat of human beings, rural-urban background, water stagnation or water scarcity, environmental sanitation, housing
Material, ventilation, crowding, domestication of animals, climate and pollution are some of the ecological variables that influence mortality patterns in different ways and to varying degrees (Mahadevan, 1986).

Conventionally it is believed that environmental factors are exogenous and they affect children only after neonatal period (Jain, 1974; Chandrasekhar, 1972; Agarwala, 1972). But environmental factors can have an impact on neonatal survival through two routes (Simmons et al., 1978). First, environmental factors influence survival of infants indirectly via mother's health and well being. There is considerable evidence of the impact of maternal infection and nutrition on the potential development of the fetus. Secondly, environmental factors may have an impact at the time of birth via insanitary unhygienic delivery practices. Hence it is appropriate to study the influence of environmental factors during both neonatal and post-neonatal period.

1.2.1. Housing Condition

Of the various ecological factors, housing condition (type of house, number of rooms, ventilation, lighting) and sanitation (provision of water, waste disposal) are often quoted as important determinants of infant mortality.
Several studies showed negative relationship of type of house with infant mortality (Gordon and Wyon, 1971; Farah et al., 1982; Preston, 1975; Mosely, 1980; Mahadevan, 1989; Khan, 1986; Sandhya, 1986; Mahadevan et al., 1985; Tara Kanitkar et al., 1988; ICMR, 1990). However, the mode of operation of type of house influencing mortality during neonatal and post-neonatal periods differs significantly among different religions and geographical area in Tamil Nadu (Ramanujam, 1987; 1988; 1991). In India, extremely poor housing conditions increase the chance of infant death (ICMR, 1988). Either the number of rooms or availability of space per household did not show any strong relationship with infant mortality (ICMR, 1988; Gunasekaran, 1988). The single room accommodation in both rural and urban, slums was significant contribute to infant mortality as a whole and in particular to the post-neonatal mortality. Another factor availability of electricity in the house was negatively related to infant mortality. Its effect on neonatal mortality was higher than on post-neonatal mortality (Tara Kanitkar et al., 1988).

1.2.2. Sanitation Condition

Higher quality of sanitary facilities and improved water supply are directly related to and epidemiologically associated with lower mortality (Puffer and Serrano, 1973). The water that a family used for drinking, cooking, washing and waste disposal is a well-known potential means of transmission of many infectious and parasitic diseases, especially those of an intestinal nature.
Gastroenteritic diseases are one of the principal causes of infant deaths in developing countries.

In Sri Lanka, Meegama (1980) found that more sanitary facilities were associated with lower neonatal and post-neonatal mortality even when controlled for other factors. Compared with those modern toilet facilities, those with none have infant mortality rates 34 percent higher, while those with buckets or cesspits have rates 13 percent higher (Trussell et al., 1983). In Mexico, Garma (1983) also found that drinking water supply and availability of hygienic facilities with toilet were positively related to infant survival.

In India, individual sanitation factors like disposal of waste material, waste water and night soil (Ramanujam, 1988; ICMR, 1988; Tara Kanitkar et al., 1988) and location of cattle shed (ICMR, 1988) showed negative effect on infant mortality. The composite index based on several sanitation factors also showed significant negative relationship with infant mortality. For example, Mahadevan (1989) through his path analysis found that index on house sanitation (water stagnation, fly nuisance, ventilation, disposal of refuse and animal excreta) has a very high negative effect on infant mortality in Uttar Pradesh followed by Andhra Pradesh and a very negligible effect in Kerala.
The source of drinking water have significant variation in infant mortality (Khan, 1988; ICMR, 1988; India: RG, 1983; Tara Kanitkar et al., 1988; Ramanujam, 1987). Households having water source within house seemed to have greater chances of infant survival than those depending on public wells or taps (ICMR, 1988; Ramanujam, 1987). The effect of safe drinking water on post-neonatal mortality was higher than on neonatal mortality (Khan, 1988; Tara Kanitkar et al., 1988; Gunasekaran et al., 1988). However, Mahadevan's (1989) three-states study reveals that sources of drinking water have shown relatively negligible effect on infant mortality. On the whole the source and location of drinking water seemed to matter in determining the infant mortality.

Gandotra and Das (1988) developed a composite index of housing and sanitation condition based on type of house, house ventilation, natural light, home sanitation, personal hygiene, water supply, cooking fuel, source of lighting and toilet facility. They found that the negative effect of housing/sanitation conditions on infant mortality persisted even after controlling the other factors.

The review indicates that at household level, housing condition and environmental sanitation are the two important sets of ecological factors usually found significantly related to infant mortality.
1.3. CULTURAL VARIABLES

It has been found that cultural variables have direct and indirect influence on infant mortality. Here the knowledge on religion and caste, value of children, cultural preferences in caring persons including provision of food, education, seeking medical help and showing affection are reviewed here.

1.3.1. Religion/Caste

Religion differentials in infant mortality have been confirmed in many societies, both developed and developing. Studies conducted in different parts of India have demonstrated that there are marginal to substantial differences in infant mortality by religion and caste. Several studies revealed that Muslims had experienced lower infant mortality than Hindus (Omran and Standley, 1976; India: R.G., 1983; Mahadevan et al., 1985; Ramanujam, 1987; Ramanujam et al., 1988). Regarding Hindus, the infant mortality was significantly higher among Scheduled Castes than Hindus (Mahadevan et al., 1985; Ramanujam, 1987, 1988; Ramanujam et al., 1988; Tara Kanitkar, 1988; Mahadevan, 1989). This may be attributed largely to backwardness and traditional customs among Scheduled Castes.

Studies conducted in Tamil Nadu reported that infant mortality was significantly lower among Scheduled Caste than other caste Hindus (Gunasekaran., 1988; Ramanujam et al., 1988). Studies conducted in Andhra Pradesh and Karnataka states also reported that
difference in infant mortality between Scheduled Castes and other caste Hindus was not significant (Sandhya, 1986; Caldwell and Ruzicka, 1985. The contradictory findings of studies conducted in different areas within the same state may be due to the differences in their cultural practices. Another possible reason is that other factors might have operated upon and nullified the effect of caste factors in one area and not all in another area. The new-pattern, viz., the lower infant mortality among Scheduled Castes than other caste Hindus emerged in rural area of Tamil Nadu indicates the need for investigation to find out the underlying mechanisms at work.

1.3.2. Traditions/ Norms / Attitudes

Culture may also manifest its influence on mortality through perceptions, attitudes and practices in societies which are bound and influenced largely by traditions and values. The following are among the important cultural determinants of child health and survival: (i) mother's power relationship within the household - control over allocation of resources (food) to herself or her child or over critical child care practices (diet, sickness care), influences child survival, (ii) beliefs about disease causation and prevention practices - choice of therapies and practitioners for sickness care, (iii) food preferences - patterns of dietary intake and choice of foods and taboos and (iv) value of son(s).

Sex differences in infant mortality are good indicators of the value system and the social customs relating to the care of
babies. In the developed countries, infant mortality among males is almost invariably higher than among females, but in several Third World countries including India (Wyon and Gordon, 1971; Arnfried et al., 1983; Das Gupta 1987; Sing, 1986) Sri Lanka (Meegama, 1980) and Bangladesh (D’Souza and Chen, 1980). Arnfried et al., (1983) in Narangwal study showed that excess of male over female deaths was found only in the perinatal stage and after that females suffered higher mortality. In the later Khanna study Das Gupta (1987) revealed that male mortality was higher than female mortality during neonatal period and thereafter it was reversed. We may probably infer that this was due to less care given to female babies during post-neonatal period.

Gupta (1986) observed in Punjab State that relative deprivation of medical care for females may be a more important factor than nutrition in accounting for sex differentials in mortality. It seems that excessive mortality of females relative to males lies in the allocation of food and health care within the household. Dyson and Moore (1983) on the other hand attributed these differentials to kinship structure and less female autonomy. In Bangladesh advantages given to male infants by way of parental care, feeding patterns, food distribution within the family, special attention to male child in the treatment of illness result in a female post-neonatal mortality rate that is 21 percent higher than the male rate (D’Souza and Chen, 1980). The degree of discrimination against girls depends on the sex composition and
total number of surviving children and parity which requires further investigation.

Infanticide was widely reported among the Polynesians in the Fiji Archipelago among the Australian Tribes, New Zealand (Westernmark, 1921); among the people of China (Baker, 1979); among the tribal and non-tribal population all over India, particularly the Nagas of Assam (Risely, 1908), the Todas of Nilgris (Rivers, 1906) the Rajputs in northern India (Barbara, 1981), Gounders of Coimbatore (Mahadevan, 1979), Piramalai kallar of Madurai district of Tamil Nadu (Ramanujam, 1991) and in Uttar Pradesh (Bhattacharya et al., 1980).

These findings indicate that traditional customs, values, norms and attitudes of society are important factors influencing the infant mortality.

1.4. FAMILIAL VARIABLES

Family is a composite variable which has several social and economic dimensions. The type of family stemming from the kinship network as nuclear, joint and extended families exert different influences on mortality. The number of members in the family and the role of several members of the kinship group may provide different opportunities and influences on child rearing leading to a beneficial or an inimical effect on the baby
(Mahadevan, 1986). The low mortality in Japan, China and Korea is largely due to the beneficial influence of kinship network of their extended family (Mahadevan, 1986).

In India, one three-states study revealed that infant mortality was the highest in nuclear families in all the three States and lowest in joint families (Mahadevan, 1989). The same finding was reported by studies conducted in rural Andhra Pradesh (Mahadevan, 1985) and both in rural and urban areas of Nilgiris district, Tamil Nadu (Ramanujam, 1987). Another study conducted in rural areas of Tamil Nadu (Ramanujam, 1988) revealed that type of family showed significant variations in the risk of post-neonatal mortality among the Vellalas and the other Hindus but not among Scheduled Castes and Muslims or in regard to neonatal mortality. However, studies conducted in rural areas (Gunasekaran, 1988; ICMR, 1990) and urban slums (ICMR, 1990) reported that type of family was not significantly associated with infant mortality.

The review therefore indicates the need for further investigation of this variable.

1.5 ECONOMIC VARIABLES

Income and wealth at the household level operate on child health and mortality through other parental, familial, ecological, conception and pregnancy, and perinatal variables. It is one of the important determinants of infant mortality. In Amman study, Belgin
et al., (1984) has shown the effect of household income differently on behavioural factors and nutritional status. The effect of household income on use of trained birth attendant (Physician or trained midwife) is more important, but less important for personal hygiene. It does not show significant effect on immunisation, sickness care but shows marginal effect on nutritional status of children. Household income does not show as much statistical reliability as the other determinants of child mortality.

In rural Andhra Pradesh, Mahadevan (1985) found that household income was positively correlated with infant mortality among Muslims and caste Hindus, but negatively correlated among Harijans. He also found that income of the family has a pronounced negative association with infant mortality in Kerala, Uttar Pradesh but an inconsistent association in Andhra Pradesh (Mahadevan, 1989).

Unanimously it has been found in all studies that assessment of family income particularly in rural area is extremely difficult. However, the expenditure pattern, especially the proportion of income spent on food provides a good measure of economic status. The average figures of expenditure on food as percentage of total expenditure were consistently higher in high IMR areas compared to low IMR areas in all the states and distinctly high in Uttar Pradesh compared to Tamil Nadu and Kerala. This suggested a higher level of economic deprivation in Uttar Pradesh than in Tamil Nadu and Kerala, with their lower income levels and higher indebtedness notwithstanding (ICMR, 1988).
A multi-centric study (ICMR, 1990) conducted in India revealed that lower family income (Rs. 300/- p.m or less) had a significant negative effect on the infant and the post-neonatal period mortality in both urban and rural areas. The relative risk was more in rural areas (1.4) with urban slums (1.2) when the family income was below Rs.300/-.

Tara Kanitkar (1988) developed a standard of living index based on modern items owned by the household and type of amenities available in the household. The index was negatively related to the infant mortality rates. She also found that household owning more than 5 acres of land have lower infant mortality rate (130) than those owning less land or no land at all (141). The effect of economic status measure by standard of living or size of land holding on infant mortality was significant even after controlling the effects of other independent factors and covariates. Its effect on post-neonatal mortality was higher than on neonatal mortality.

Moosley (1983) and Jain (1988) analysed infant mortality in Kenya and India respectively and demonstrated the importance of poverty level in explaining regional differences in infant mortality.

1.5.1 Socio-Economic Variables

Extensive evidence suggests that the economic and social conditions into which children are born strongly influence their
survival. Consequently, infant mortality has been used frequently as an indicator of the standard of living.

Some developing countries have placed great importance on radical improvements in the social conditions of their populations, in particular with regard to education and health promotion and protection, and an equal access to them. On the other hand some countries have followed the strategy of expanding economic growth for raising living standards and meeting the basic needs of the population (such as education, health, sanitation). The economic growth does not automatically lead to better health status of population. For instance, several countries with strong economic growth, like Brazil, still exhibit high mortality rates, while some poor countries, like Sri Lanka, have substantially reduced their mortality rates. However, a recent review of mortality conditions in South and East Asia concluded that there was no evidence to suggest that substantial progress in the health status of a population has been achieved in the absence of economic development (Preston, 1978). Even in the case of Kerala, where the progress in social development, as reflected by gains in education and literacy and increased political participation, has been cited as the principal factor underlying mortality declines. This development is, in turn, the consequence of equity considerations which have led to more equitable distribution of land and income, higher productivity and economic output, and better nutrition (Ratcliffe, 1978).
Nag (1983), while comparing the state of Kerala with West Bengal, attributed the lower infant and child mortality in Kerala to its higher social development. But, Jain (1988) demonstrated the importance of economic factor - poverty level which has an independent effect on infant mortality, presumably because of an increase in neonatal mortality associated with poor nutrition of mother during pregnancy.

A few studies attempted to correlate socio-economic status index at the household level with infant mortality. A cross-cultural international study (Omran et al., 1976) reported that the infant mortality was higher in low social status (education of head of household, occupation of head of household, income, number of persons per room) groups than in the middle status groups in all countries. In rural Tamil Nadu, Muthiah (1990) found that the infant mortality was significantly higher in low social status than in the middle status groups for other Hindus, and Scheduled Castes.

Gandotra et al., (1988) considered socio-economic status of household based on education of the head of household, occupation, caste, social participation, land holding, farm power, material possession, type of family and family size. He found that socio-economic status was negatively correlated with neonatal mortality as well as post-neonatal mortality. Socio-economic status was an important factor influencing the risk of neonatal and post-neonatal mortality.
The results from the above studies at the micro and macro levels indicate the importance of socio-economic status in determining the variations in infant mortality.

1.6 MARITAL VARIABLES

The age at marriage is one of the important variable among marital variables like monogamy, polygamy, inbreeding, stability of marriage, marriage cost, problems of married life (Mahadevan et al., 1989). The physical and emotional state of mind and the variegated experiences that accumulate with age may be responsible for the different nature of influence of the age at marriage on infant mortality.

The National Academy of Sciences (1970) reported that mothers married under 17 years of age show higher infant mortality rates, while the risk for mothers between 17 to 19 years was similar to that for mothers between 20 to 24 years of age. In Bangladesh, the highest neonatal mortality rate was found among mothers married below the age of 20 years. Neonatal mortality rate gradually decreased among mothers between 20 to 24 and 25 to 29 years of age (Islam et al., 1982).

In India, Registrar General (1983) showed that infant mortality rate was significantly lower when the age of marriage was
'21 year and over' for both rural and urban areas. In Andhra Pradesh, Mahadevan et al., (1985) found that age at marriage was negatively associated with infant mortality among Muslims, Harijans and Caste Hindus, but the association was found to be significant among Harijan. He (1989) also found in three-state study that age at first birth was significantly negatively correlated with infant mortality.

The age at marriage and age at first birth have definite influences on the size of the infant death rate.

1.7 PARENTAL VARIABLES

Parental factors constitute a heterogeneous cluster of variables pertaining to biological, social, cultural (life style) and psychological dimensions. Here, the education and occupation of parents under social dimension, and age and health of mother under biological dimensions are considered.

1.7.1 Age of Mother

Because of biological links between the mother and infant during pregnancy and lactation, the mother's age, health and nutritional status as well as her reproductive pattern influences the health and survival of the child. Generally infant mortality showed a U-shaped or J-shaped interrelationship with the age of mother (Stockel and Chowdhury, 1972; Omran et al., 1976; Mahadevan, 1985; ICMR, 1990; Talwar, 1988).
Various studies have showed high incidence of pregnancy associated hypertension and eclampsia, low birth weight, prematurity and caesarian section with lower age (Guerrio, 1975). Also a young mother, due to her lack of experience, may not be able to take proper care of the young infant. In poor socio-economic groups 30 percent of primi gravidas are teenagers. In the Indian situation there is a considerable support to primes from the kinship group. This could be an asset as well as a major constraint. The traditional outlook, illiteracy and superstitions of old family members with respect to infant care, may not be conducive to infant health and survival. Beyond the age of 30 again the risk of pregnancy complications increase resulting in high infant deaths (Leela Raman, 1989). Therefore, biological and behavioural variables are underlying factors for the general pattern of U-shaped or J-shaped relationship.

The age of mother showed a reversed J-shaped relationship with neonatal mortality (Omran et al., 1976; Ramanujam, 1987). Though the age of mother was significantly associated with post-neonatal mortality in general population (Gandotra et al., 1988) and particularly among Scheduled Castes (Omran et al., 1976; Ramanujam, 1988), it seemed to affect early neonatal component more than late neonatal and post-neonatal (ICMR, 1990).

Mahadevan (1985) observed positive relationship between maternal age and infant mortality among Muslims, Scheduled Castes and other caste Hindus in rural Andhra Pradesh State. While others
(Gandotra et al., 1988; Talwar, 1988; Ramanujam, 1988) found a significant association between the maternal age and infant mortality. Gunasekaran (1988) observed the non-significant relationship during both neonatal and post-neonatal periods. This indicates that when the effects of various factors are adjusted the effect of maternal age on infant mortality may differ. For example, in rural Bangladesh, Kabir (1984) found that in the univariate analysis that the mother's age showed consistent patterns of effects on mortality i.e., U-shaped relationship between age of mother at child birth and infant mortality, but when other variables (birth interval, birth order, religion, education, region) are controlled there is no significant influence on mortality apart from neonatal mortality. In Mexico, Garma (1983) also found that maternal age was negatively related to infant survival. But the mother's age at child birth equation does not appear statistically significant in the regression.

Age and parity are usually highly correlated and therefore it is difficult to isolate their independent contribution to the risk of infant death. The cross tabulation of maternal age by parity for the studies conducted in Tamil Nadu (Omran et al., 1976) and Sri Lanka (Meegama, 1980; Trussel et al., 1983) revealed that mother's age at birth of child does have an effect on neonatal and infant mortality. The first births suffers high mortality because they occurred predominantly to young women. Tara Kanitkar et al., (1988) applied multiple classification analysis to the data for
rural Rajasthan and Orissa States and showed that both maternal age and parity affect neonatal and post-neonatal mortality independent of each other; the effect of birth order was less pronounced than the effect of maternal age; and the effect on the risk of neonatal mortality was more pronounced than that on post-neonatal mortality. These indicate that the age of mother is more important than parity.

1.7.2 Education of Mother

It is generally accepted that there is a linkage between increased maternal education and reduced child mortality as much as education gives women the power and the confidence for decision-making on their own. Caldwell (1979) has argued that three factors are of importance in this regard. These are (i) a reduction in fatalism in the face of children's ill health; (ii) a greater capability in manipulating the world and (iii) a change in the traditional balance of family relationships that shifts the focus of power away from the patriarch and the mother-in-law and ensures that a greater share of available resources is devoted to children.

In the developing world there is now clear evidence of differentials in child survival rates associated with the education of mother. Several studies conducted in different parts of India (Ruzicka and Kanitkar, 1972; Vaidyanathan, 1972; Reddy and Sholapurkar, 1983; Leela Visaria, 1988; Jain, 1985, 1988; Khan, 1988; Ramanujam, 1988; Gunasekaran, 1988; Gandotra et al., 1982, 1988; Tara
Kanitkar et al., 1988; Mahadevan et al., 1985; Ramanujam et al. 1988; Mahadevan, 1989; Caldwell et al., 1981, 1982; Registrar general, 1983) show a negative relationship between the extent of maternal education and the level of infant/child mortality.

The independent effect of mother's education on infant mortality varies from culture to culture. A cross culture study in rural areas of Tamil Nadu showed that mother's education influenced the level of neonatal mortality among the Vellalas and other caste Hindus and the level of post-neonatal mortality among other caste Hindus (Ramanujam, 1988). While the effect of mother's education was almost the same in neonatal and post-neonatal mortality in urban areas, in rural areas the impact was much more on early neonatal mortality (ICMR, 1990). Its effect on post-neonatal mortality was higher than neonatal mortality (Tara Kanitkar et al., 1988). The effect of mother's education on post-neonatal mortality is due to better utilisation of postnatal care (Gandotra et al., 1988).

The education factor, apart from its independent impact on child survival, is also interrelated to other determinants of mortality (Preston, 1985; Trussel et al., 1983; Mahadevan, 1989). The effects of two factors: role of social development - as indicated by female education - and health seeking behaviour may be synergistic. This is supported by Nag (1983) and Jain (1985). Nag compared the States of Kerala and West Bengal and attributed the lower mortality in Kerala primarily to its higher social development.
and partly to its favourable environmental and hygienic conditions (Nag, 1983). Jain compared the education-specific infant mortality in rural areas of Kerala and Uttar Pradesh and showed that the effect of improvements in both education and medical services is likely to be higher than the sum of two individual effects (Jain, 1985; 1988). Analysis of major States in India also demonstrates the complementarity in the roles of female education and health services in explaining the regional variations in infant mortality (Jain 1985, Gunasekaran et al., 1988). Jain (1985) demonstrated the independent effects of household property and availability and use of medical services, and, consistent with Palloni (1981), found that much of the effect of female literacy operated through these factors.

1.7.3 Education of Father

Father’s education may influence attitudes and norms in choice of consumption goods, including child care services. This effect is likely to be most significant on child survival when more educated fathers are married to less educated mothers (Mosley et al., 1984). Therefore, the relationship of father’s education with infant mortality is reviewed here.

Studies conducted in rural areas of India revealed that education of father had a strong negative relationship with infant mortality (Mahadevan et al., 1985; Ramanujam et al., 1987).
Mahadevan, 1989). On the other hand, study conducted in rural area of Tamil Nadu (Gunasekaran, 1988) and Bangladesh (Chowdhury, 1981) reported the non-significant association between father's education and infant mortality.

In Sri Lanka, for each level of mother's education, neonatal mortality by husband's level of education progressively decreases as level of education rises. No definite pattern was observed for post-neonatal mortality (Meeyama, 1980). Cochrane (1980) summarised the results of ten studies and concluded that increasing mother's education was more important than increasing father's education in reducing infant mortality, a conclusion not confirmed by Trussell and Preston (1982) for either Sri Lanka and Korea. For Sri Lanka, father's and mother's education are the co-variates with the biggest differential impact, as expected from the previous work of Trussell and Preston (1982). The differential for father's education was substantially higher than that for mother's education, a finding in sharp contrast to Cochrane's (1980) conclusion (Trussell et al., 1983).

The review indicates that either the joint effect of mother's and father's educational level or superiority of each one on infant mortality is not established for rural areas of India.
1.7.4 Occupation of Father

Occupation of father is a measure of the work status and environment of the head of family. These factors may affect the organisation of home life and resourcefulness of the household to obtain better health care. Studies relating the occupation of father with infant mortality are few.

In Sri Lanka, the professionals and other white collar workers such as clerical and sales workers have the lowest level of neonatal mortality (Meegama, 1980). The infant mortality among professionals skilled and unskilled workers is lower than that of agriculturist in rural Bangladesh (Kabir, 1984). Occupation of husband appears to have significant effect on child mortality in the rural area of Matlab of Bangladesh (Ashraf Uddin Ahmed, 1985). In Korea, Park et al., (1981) found that the difference in child mortality between rural and urban areas largely explained by occupation of husband and the explaining powers of residential background and of the women's educational level, which are almost identical lag behind that of husband's occupation. The Amman study (Belgin Tekce et al., 1984) revealed that the occupation of the head of the family appears to play a role in child health but it was not consistently strong one.

Both in the Narangwal study villages in India and Matlab area in Bangladesh, children of agricultural labourers experienced the highest mortality rates, followed by children whose parents
farmed both their own and other people's land, and then by landowner's children (Taylor et al., 1978; D'Souza et al., 1982).

In India, Mahadevan (1985) found that infant mortality was significantly associated with occupation of father among Muslims, Harijans and caste Hindus in Andhra Pradesh State. Occupation of father was significantly associated with neonatal mortality in urban areas but not in rural areas of Nilgris district in Tamil Nadu (Ramanujam, 1987). In another study of four cultural groups in Tamil Nadu, a significant association was found among Muslims but not among other groups; Vellala Gounders, Scheduled Caste, and other Hindus (Ramanujam, 1988). On the other hand two studies conducted in rural areas of Tamil Nadu showed no significant association between occupation of father and infant mortality (Ramanujam, 1991, Gunasekaran, 1988).

1.7.5 Occupation of Mother

In traditional societies, a sharp division of labour by sex maximize the mother's time for child care. On the other hand, in transitional societies, characterisation of many developing countries child care time often compete with time needed for income generating work. The effect of mother's work on infant/child mortality depends on the structure of the family, particularly on the availability of the other family members to take care of children in the mother's absence. Some studies have concluded that
Infant mortality is lower among women who work because family income is higher (Schultz 1980, Merrick 1981). The mother's work situation did not have much effect on child mortality in Brazil (Sawyer, 1983).

In rural areas of Tamil Nadu, Ramanujam et al. (1987) found that occupation of mothers was significantly associated with neonatal mortality. Ramanujam (1988) while studying four cultural groups (Vellalas, Muslims, Scheduled Castes, Other Hindus) found that significant differences were associated with the occupation of the mother only with respect to post-neonatal mortality among the Scheduled Castes but not among other three groups. A higher probability of post-neonatal death among children of Scheduled Castes women working as labourers than among the offspring of cultivator mothers seems, prima facie, a reflection of the poor economic status of the former. A similar relationship was observed among other three groups, though the differences were not statistically significant. Gunasekaran (1988) in another rural area of Tamil Nadu found that babies of working mothers faced a higher risk of neonatal death (not significant), but there was no such link with the risk of post-neonatal mortality. These results indicate that the underlying relationships here are quite complex and are related to the income or economic status of the household, and the workload and nutritional status of the pregnant woman at various stages of pregnancy. These links remain to be unravelled.
A great deal of confusion has been generated by the tendency to equate work for women with paid employment outside the home and therefore to label all other women as non-workers despite their indispensable contributions to the household by doing hard work like head carrying heavy loads of water or de-husking rice etc. Nature of work during pregnancy, resuming household work or outside home after delivery for both working and non-working women should be investigated while studying the association between occupation of mother and infant mortality.

1.8 CONCEPTION AND PREGNANCY VARIABLES

The bio-social factors (age at conception, pregnancy problems, nutritional status of mother, weight of mother and its change) and pregnancy care factors (education, pregnancy medical care, intention to care pregnancy) have tremendous influence on the outcome of pregnancy and the later survival of children. Most of these factors have antecedent causal factors which may be either socio-economic or cultural in origin (Mahadevan, 1986).

1.8.1 Age at conception

A large proportion of rural girls who are at obstetric risk (as per the WHO criteria) started their reproduction from around 15th year. In addition to the increased risk posed by their current immature body stature, there is also a crucial difference with respect to pregnancy as between a 15-year-old girl and an 18-
year-old girl. In the later case, there are two competing nutrient demands on the mother during pregnancy: the demand for repair and maintenance of her own tissues and the demand for foetal growth and development. In the case of the former, however, in addition to the above two demands, there is also the added competing nutrient demand of the mother for her own further growth which could be quite exacting and significant. Therefore the incidence of low birth weight deliveries is significantly greater and resulting in early neonatal mortality in young primi para (Gopalan, 1989).

Several studies show an U or a J-shaped relationship between infant mortality particularly neonatal mortality and age of mother. Results were already reviewed and discussed under 'Parental Variable' in this review.

1.8.2 Maternal Nutrition

Survival of children is influenced by nutrients (calories, protein and micronutrients) available not only to the child but also to the mother. Maternal diet and nutrition during pregnancy affect birth weight and, during lactation, influence the quantity and nutrient quality of breast-milk. Surveys in Asia and Latin America indicate that during pregnancy the total energy intake is deficient, often by several hundred kilo calories, and that intake of all nutrients are generally low (Margaret et al., 1983). A three-states study conducted in India reported that majority of women do not take any care during pregnancy and lactation with regard to foods.
Certain foods are promoted while nourishing foods are avoided (Mahadevan, 1989). A consistent inverse relationship has been shown between maternal nutrition and infant mortality in several countries (Lechtig et al., 1977; Latham 1968; Habicht et al., 1976; Winikoff, 1978; Wray, 1977; Chen et al., 1980; Mahadevan 1989).

In India, nearly one-third of babies born in the country are of low birth weights. Low birth weight of offspring is not only an evidence of poor maternal nutritional status but is also an indicator of possible poor future development of the baby. A close association has been shown between infant birth weight and infant mortality (Kasturilal et al., 1974; Ghosh et al., 1974; Bhandari et al., 1983; Karan, 1972; Leela Raman, 1989; ICMR, 1990; Bhargava et al., 1989). The Pan American study on mortality as well as other studies have shown the importance of the differential influence on maternal nutrition and maternal weight (PAHO, 1971; Wray, 1983; Mosley, 1977).

A mother who has poor nutrient intake is not only deficient in body weight (a reflection of poor calorie intake) but also suffers from higher incidence of mother deficiency signs like Vitamin A, Vitamin B etc., as well as anaemia. A close association has been shown between the incidence of prematurity, low birth weight and perinatal mortality on one hand and the level of haemoglobin on the other (Prema et al., 1981, ICMR, 1975; Menon, 1967; Prema, 1983). In developing countries maternal anaemia
accounts for high rates of foetal loss (12-28 percent, perinatal deaths 30 percent) and neonatal deaths (7 to 12 percent). The remaining live births have around a 50 per cent chance of resulting in a low birth weight baby (Agarwal, 1984). 10-20 percent of women at any time of pregnancy have haemoglobin less than 9 gm which is conducive to poor reproductive outcome (Leela Raman, 1982). Studies shown a strong relationship between maternal haemoglobin and early and late neonatal mortality (Saramma Thomas Mathai, 1989; Agarwal, 1984;ICMR, 1990; Gandhi et al., 1980). Mahadevan et al., (1985) also observed the negative association between haemoglobin level of mother and infant mortality among three groups viz., Muslims, Harijans and caste Hindus. The highest incidence of mortality among Muslims compared to Harijans and Caste Hindus was due to poor pattern of food choices which resulted in a low level of nutritional status for mothers.

1.8.3 Pregnancy Care

Parental health care and health education has a very positive correlation to health and survival of the infants. Studies conducted in different parts of India revealed that good antenatal care and utilisation of MCH care were negatively associated with incidence of still birth (Datta et al., 1975; Ramanujam et al., 1984; Ramanujam, 1987), low birth weight of babies (Vaidya et al., 1970; Ramanujam et al., 1984), perinatal deaths (Datta et al., 1975, Kishore, 1983; Ramanujam, 1987), neonatal mortality (Ramanujam

A prospective study conducted in rural areas of Tamil Nadu (Ramanujam, 1987) reported that still births, perinatal mortality, neonatal mortality and post-neonatal mortality varied among three different MCH service areas. The difference in neonatal mortality rates among three service areas was significant. Morbidity of mother and child was significantly different among three different service areas.

The review under conception and pregnancy variable indicates the influence of bio-social factors, nutritional status of mother, and pregnancy care on infant mortality. Regarding the factor intention to care pregnancy, few studies considered and covered it. When the conception is going to result in as the latest addition to a family that the parents feel is already large enough, intention to care pregnancy may be at low level. This will affect the survival of infant. In Thailand, FreuZen and Hogan (1982) showed that whether births were wanted had significant independent effect on infant mortality even when the effects of other social variables were taken into account. Further investigation is necessary to study the effect of intention to care pregnancy on survival of infant in Indian condition.
1.9 PERINATAL VARIABLES

The major variables that relate to delivery care together with the follow-up measures adopted soon after delivery are broadly grouped into growth (prematurity, birth weight, multiple birth), delivery care (birth attendant, place of delivery, materials used), post-delivery care (baby attendant, prelacteal feeds, colostrum, breastfeeding, supplementation) and demographic characteristics (parity, child sex, size, birth interval) (Mahadevan, 1986).

1.9.1 Growth Factor

Prematurity and birth weight are important determinants of infant mortality. Prematurity is assessed based on gestational age. In India, the single most underlying and contributory cause for neonatal deaths is the prevalence of low birth weight from 20-50 percent and preterm births of 7-14 percent (India: R.G., 1984). Neena Datta (1986) has reviewed most of the studies conducted in India and reported that prematurity was the top cause of death during perinatal period. The recent ICMR (1990) study reported that nearly 20 percent of deliveries in both rural and urban areas were pre-term (less than 37 weeks gestation). The neonatal, post-neonatal and infant mortality was significantly higher in preterms in comparison with term infants.

Birth weight, which often reflects both the mother's nutritional status and the gestation period, is the best predictor
of a baby's chances for survival and healthy growth and development.

The WHO defined low birth weight as babies with a birth weight of less than 2,500 gms. According to the WHO report, Asia is the region in the world with the highest incidence of low birth weight, 19.7 per cent, three times the lowest of 6.5 for Europe in 1982.

For India, studies reviewed by Ruth (1985), Neena Datta (1986) and Leela Visaria (1988) revealed that the incidence of low birth weight was between 20 and 37 percent. A significant association has been shown between infant birth weight and infant mortality. The perinatal and late neonatal mortality were significantly higher among low birth weight babies than babies with birth weight of 2,500 and more (Neena Datta, 1986; Vijaykumar, 1986; Ruth, 1985; Kasturilal, 1974; Ghosh et al., 1974; Bandari et al., 1983; Karan et al., 1972; ICMR, 1990). Of course, many factors influence the birth weight of the fetus, maternal diseases and conditions, age of pregnant woman, nutritinal status, height and weight, birth interval, percapita income, literacy and education etc.

The knowledge on the incidence of multiple births and mortality among multiple births is very limited.

1.9.2 Delivery Care

In rural India as a whole, nearly 14.9 percent of births took place in hospitals, nursing homes, maternity homes, etc. during 1988. It was 49.7 percent for urban in 1988. The proportion of births delivered by trained practitioners was 74.5 percent in urban areas and about 33.5 percent in rural areas during 1988 (India:
Registrar General, 1988). This indicates that majority of the rural births take place at home and are attended by village dais or other family members.

The place of birth influences the personnel (trained or untrained) and the materials used for conducting delivery. As most of the deliveries take place at home in rural areas, the untrained practitioners used kitchen knife or sickle or any powder that is available for cutting and dressing the umbilical cord (Tharanisingurajan et al., 1978; Ramanujam, 1992; Mahadevan 1989). In domiciliary deliveries tetanus claims the lives of many infants (Simmons et al., 1979, Mahadevan et al., 1985). Wrong handling of delivery by quacks or unskilled persons also causes birth injury and infections.

The infant mortality rate has been to be significantly higher among babies delivered at home than among those born in institution (Ramanujam, 1987, 1991; ICMR, 1990; Tara Xanitkar et al., 1988). There are also, studies which reported that infant mortality was higher among babies delivered in institutions than among those born at home (Rao et al., 1988; ICMR 1990). This finding has been explained to be the result of selectivity of the sample of births.

A majority of rural births take place at home and are attended by village dais or other family members. Dais were trained
in hygiene and safe delivery practices since second Five Year Plan. Studies conducted in rural areas reported significant differences between the trained and untrained traditional birth attendants in the practice of proper hand washing, the knowledge and practice of aseptic handling of the newborn, practice on umbilical cord care, and the knowledge on neonatal tetanus. Regarding the use of instruments for cutting the cord, there was little difference between trained and untrained dais (Leela Visria, 1988; Ramanujam, 1992).

The type of birth attendant—trained or untrained—influences survival of infants. In Uttarpradesh, tetanus mortality among babies delivered by untrained birth attendants was significantly (three times) higher than among babies delivered by trained birth attendants (Smucker et al., 1980). In Karnataka, a small but not very significant difference in the IMR among babies delivered by trained and untrained birth attendants was observed (Reddy and Sholapurkar 1983). Jain (1988) in his analysis of regional variation in infant mortality reported that trained medical birth attendant negatively related to neonatal mortality. Birth attendant and poverty explain 62 percent of the regional variation in neonatal mortality in India. Mahadevan (1989) in his three states study also reported that delivery attendant was significantly correlated to infant mortality in all the three States.
Several studies reported that neonatal mortality or infant mortality was higher among babies delivered by trained birth attendants (trained Dais, Auxilliary Nurse Midwives - ANM, Doctor) than among babies delivered by untrained birth attendants (untrained Dais, relatives) (Rao et al., 1988; Tara Kanitkar et al., 1988; Talwar, 1988; Mahadevan 1989; Gunasekaran, 1988; Ramanujam, 1987, 1988, 1991; Khan 1988; ICMR 1990). This suggests some selectivity in that the trained birth attendants may be attending to more number of difficult or complicated deliveries.

While comparing mortality risk between programme persons and Dais, it was observed that the neonatal mortality or infant mortality among births delivered by a doctor/nurse or ANM was lower than that among those delivered by a Dai. (Gunasekaran, 1988; Mahadevan, 1989; Ramanujam, 1987, 1988, 1991). While comparing trained Dais with untrained Dais, the neonatal mortality or infant mortality was higher among births delivered by trained Dais than that among those delivered by untrained dais (Gunasekaran, 1988; Ramanujam, 1991). This may be due to selectivity of cases when trained Dais were consulted. On the other hand, studies (Mahadevan, 1989; Ramanujam, 1987; ICMR, 1990) reported that infant mortality was higher among births delivered by untrained Dais than that among those delivered by trained Dais.
1.9.3 Post-Natal Care

Among the post-natal care factors that influence the chances of survival of the new-born, the baby attendants, prelacteal feeds, providing colostrum, the timing of initiation of breast feeding, duration of lactation and the timing of supplementary semi-solid food are important factors.

Type of persons attending on baby during post-delivery period is an important factor that influences the survival chances of infants. If the delivery takes place in a hospital immediate care for a couple of days will be provided by qualified persons which may reduce the chances of neonatal mortality but such care is not available when the delivery takes place at home where three-fourth of deliveries were attended by untrained Dais and untrained functionaries. Wrong and unhealthy practices (hands washed in ordinary water, without sterilized gloves) may cause throat infection to the new-born leading to possible morbidity and mortality. This was found as 91 to 93 percent of the cases in Uttarpradesh and Andhrapredesh respectively. This may be one of the factors that causes the differential morbidity and mortality (Mahadesvan, 1989).

1.9.3.1 Prelacteal Feeds

Since, in a large proportion of the population, breast-feeding is not initiated for one to three days, the new-born are
given some prelacteal feeds. Such feeds include sugar water, honey, goat’s or donkey’s milk, musk, gorojanam, glucose water, herbal concoctions prepared with water, ghee or castor oil, neem oil, cow or buffalo’s milk, and coffee (Mahadevan et al., 1985; Leela Visaria, 1988; ICMR, 1988). Hardly any studies indicate whether water used to prepare prelacteal feeds is boiled or not and the manner in which these feeds are given. When infants are given these feeds they could have been exposed to a number of morbidity conditions and increased the mortality risk. The effect of prelacteal feeds on the newborn infants is an important subject for research.

1.9.3.2 Colostrum

Immediately after delivery breast milk is yellowish and sticky. This milk is called colostrum and is secreted in the first week. The practice of discarding colostrum is quite widespread. The percentage of mothers who discarded colostrum is more than 62 percent in Uttar Pradesh and Tamil Nadu, while in Kerala it is not more than 25 percent (ICMR, 1988). About 59 percent of mothers in rural Tamil Nadu discarded the colostrum (Ramanujam, 1980). The reasons for the practice of discarding colostrum appeared to be the wrong belief that the colostrum is (i) inferior (unhealthy, type of milk and causes a number of diseases in infants such as stomach upset, eye sore etc. (ICMR, 1988); (ii) heavy or not good for the baby (Leela Visaria, 1988); (iii) harmful to infants and might affect their health (Mahadevan et al., 1985); (iv) dirty (“pus”) and
harmful; and (v) cause of indigestion /cold/vomiting and (vi) a custom (Ramanujam, 1980).

When infants are not fed with colostrum, they are exposed to a number of morbid conditions (Priyani, 1981; Chandra, 1978). The practice of discarding colostrum has significantly increased the chance of mortality risk (ICMR, 1988).

1.9.3.3 Breastfeeding

Among the several factors that affect infant mortality, breastfeeding is one of the major variables. It has several components beginning with the prelacteal feeds, followed by initiation of breastfeeding, frequency of breastfeeding, duration of breastfeeding and weaning practices.

The advantages of breastmilk have been established through various studies as follows: (a) nature’s provision for baby, (b) sterile and uncontaminated, (c) balanced in nutrients, (d) no need for any preparation or warming and (e) immunogenic property.

The breastfeeding is universal in India. In majority of the community studies, the breastfeeding is initiated at least 24 hours after births and often after 48 or 72 hours (Leela Visaria, 1988; Mahadevan, 1989; ICMR, 1988; Ramanujam, 1989). Late initiation of breastfeeding mostly resulted in discarding colostrum
can have a detrimental effect on the health of new-born and may have a bearing on infant mortality. Three States studies (ICMR, 1988; Mahadevan, 1989) showed that early (first day) initiation of breastfeeding has significantly reduced infant mortality risk.

The type of breastfeeding — exclusive breastfeeding, exclusive artificial feeding, and mixed feeding — at different months during infancy are found to be associated with mortality risk in America (Woodbury, 1992). In Brazil, artificially fed infants have a relative risk of death from diarrhoea of 14.2, and from pneumonia of 3.6, compared with exclusively breastfed babies. The risk for partially breastfed babies is immediate (Victoria, 1987). In Scotland, babies who are breastfed for 13 weeks or more had a reduced risk of diarrhoea and respiratory infection which persists through out the first year of life (Howie et al., 1990). Exclusive breastfeeding reduces mortality risk. Very few babies anywhere in the world are exclusively breastfed and most receive some form of supplement — other milk, gruel, water, tea, fruit juice, or something else — by age of 1 or 2 months. Giving anything other than breastmilk — even water or herbal teas — increased the prevalence of both diarrhoea and respiratory infection (Brown et al., 1989). In Turkey, frequency and severity of diarrhoea were found to be significantly higher in partially breastfed infants than in those of fully breastfed infants (Ozalp et al., 1992).
Studies conducted in Central and Southern America (Puffer et al., 1973), Germany (Knodel, 1978), Bangladesh (Kent, 1981), Bolivia (Koopman, 1983), Andhra Pradesh - India (Mahadevan et al., 1985), Guatemala (Pinal, 1981), three States - India (Mahadevan, 1989) documented that breastfeeding significantly depresses infant mortality. A large proportion of infant mortality (35-40 per cent) among three cultural groups, mostly within 4 days after birth, occurred in the absence of breastfeeding. The duration of breastfeeding is negatively associated with infant mortality (Mahadevan et al., 1985).

Majority of studies measure the 'total duration' of breastfeeding, not the 'true duration'. Total duration includes all patterns of breastfeeding (a mother could be nursing only once a week and still be included in the statistics). True duration defines the period of exclusive breastfeeding and is a more significant measurement when looking at the child survival aspects of infant feeding. Moreover, whether the breastfeeding was stopped before the death of infant or stopped because of death i.e., the gap between stopping the breastfeeding and death of infant is more important while comparing the duration of breastfeeding between survival and diseased infant. These should be investigated.
1.9.3.4. Supplementation

Breast milk fulfills the infant's total nutrient requirement through 4 to 6 months of age. If introduction of supplement food is delayed after 4 to 6 months of age, or if is not given in sufficient quantity to satisfy nutritional needs, the growth of child will be affected. The type of supplement food, mode of feeding, cleanliness of feeder are important source of infection.

In rural Andhra Pradesh, most of the infants below age of six months were given liquid food (animal milk and or both tinned milk) and solid foods were given from sixth month. Supplementary foods were initiated anywhere between six to thirteen or more months; the highest frequency distribution of age at supplementation being between seven and twelve months (Mahadevan et al., 1985). Supplementary foods were mostly cereal/pulse combinations and commercial biscuits.

A Pakistan study found that by one month, 18 per cent of infants were given supplements. Over one third of Filipino infants receive supplements by two or three months and in India one quarter of infants were given supplements by two months. A Nepal study found that 50 per cent of "exclusively breastfed infants" were given supplements (Baumslag, 1989). A recent WHO study shows that many mothers now start to give foods other than breast milk to their infants at two or three months of age. The proportion of rural
mothers who started supplementation early was not high as high as for those in the urban areas (WHO, 1981). Early supplementation was due to the belief that mother's milk was either weak or inadequate. Late supplementation was due to the financial inability of the parents to purchase milk for feeding the child.

Early as well as late introduction of supplementary feeding is associated with infant mortality. The timing of introduction of supplementary feeding showed a U-shaped relation with post-neonatal mortality (Gunasekaran, 1988).

Weaning is a dangerous time for infants and young children. It is well known that there is a higher rate of infection, particularly of diarrheal diseases, during weaning than at any other period in life. This is because the diet changes from clean breast milk which contains anti-infective factors, to foods which are often prepared, stored and fed in unhygienic ways. Weaning starts at different times in different communities.

In rural Andhra Pradesh, Mahadevan et al., (1985) found that majority of the mothers weaned their children between 13 and 24 months. In his three States study, weaning begins at six to seven months among the majority of the mothers reporting. The highest infant mortality occurs at six to seven months of weaning in total of all the three States irrespective of sex.
1.9.4. Demographic Characteristics

Birth order, sib-ship size and birth interval are exerting a definite pattern of influence on infant mortality. The findings related to the association of these factors with infant mortality are discussed in this section.

1.9.4.1. Parity

Several studies showed a U shaped or J - shaped relationship of infant mortality/early neonatal mortality with parity (Omran and Stanley et al., 1976; Mahadevan et al., 1985; Leela Visaria, 1988; Rao et al., 1988; Khan, 1988; Gunasekaran, 1988; Ramanujam, et al., 1987, Ramanujam, 1987, 1991; Tara Kanitkar, 1988; Talwar, 1988; ICMR 1990; Saksena and Srivastava, 1980). The infant mortality is usually found to be high for the first order and high order births (about 4 and higher parity), and low for the middle range (second to fourth order births). The effect of birth order on neonatal mortality is more pronounced than that on post-neonatal mortality (Tara Kanitkar et al., 1988; Khan, 1988; Ramanujam, 1988; Gandotra et al., 1989). Parity has an independent relationship with mortality even when the factor of social class is controlled (Heady and Morris, 1959). Contrary to this, parity did not show a significant relationship with neonatal mortality but showed a significant relationship with post-neonatal mortality (Gunasekaran, 1988). Ramanujam (1991) also found in rural Tamil Nadu that parity did not show a significant relationship with both
neonatal and post-neonatal mortality. This may be due to other factors like delivery of MCH services which might have nullified the effects of parity on infant mortality.

The age of mother and parity are highly correlated and therefore it is difficult to isolate their independent contributions to the risk of infant death. Analysis of independent contributions of age and parity to the risk of infant death particularly neonatal death showed that the effect of birth order is less pronounced than the effect of the (Tara Kanitkar et al., 1988; Ramanujam, 1991; Meeegama, 1980). Another factor that confounds the effect of parity on the risk of infant mortality after controlling the effect of both age and birth interval. No attempt has been made to study the effect of parity on the risk of infant mortality after controlling the effect of both age and birth interval. Gandotra et al., (1988) reported that higher parity births (5 or more) and births following a short interval (19 months) have the highest risk of death during both the neonatal and post-neonatal periods. Second to fourth order births and births following a birth interval of 31 months or more have the lowest risk of death during both the neonatal and post-neonatal mortality.

1.9.4.2. Birth Interval

Several studies showed the inverse relationship between infant mortality and birth interval (Mahadevan et. al., 1985; Mahadevan, 1989; Khan, 1988; Ramanujam, 1988; Gandotra et. al.,
The mechanisms through which birth spacing affects child survival are important to understand. Parity and birth interval are highly correlated. Gandotra et al., (1988) studied both the joint effect of parity and birth interval as well as net effect of birth interval after adjusting the effects of other factors (such as mother's age and education) on the risk of neonatal and post-neonatal mortality. The results showed that irrespective of the birth order, the risks of neonatal, post-neonatal mortality for births following a short interval (18 or less months) are higher than those births following intervals of 19 or more months. The adjustments for the effects of other factors do not appreciably reduce the effect of birth interval. Among the second to fourth order births, the effect of short intervals on neonatal mortality is more pronounced than that on post-neonatal mortality. However, among the fifth and higher order births, there is not much difference between the effects of short intervals on neonatal and post-neonatal mortality; the longer birth intervals (31 or more months) are also associated with higher than average risk of post-neonatal mortality.

The effect of birth spacing on neonatal mortality operates through both the biological factors (such as low birth weight and prematurity) and the behavioural factors (such as breastfeeding). The effect operating through the biological factors
is likely to be much more pronounced than that operating through the
behavioural factors. The effect of birth spacing on post-neonatal
mortality, on the other hand, may operate primarily through the
behavioural factors-breastfeeding and other child care variables-
both medical and non-medical (Jain et al., 1988).

More research should be undertaken to identify the ideal
birth interval for better child survival and understand the
mechanisms through which birth spacing affects child survival.

1.9.4.3. Sib-ship size

First born children and those who follow many brothers and
sisters exhibit high mortality. Compared with children born second
or third, excess mortality of first borns are no longer at a
disadvantage. Mortality of children of high birth order is high at
all ages. These children may suffer from competition from
siblings, are more likely to be cared for by someone other than
their mother (usually an older sister), and their births are more
likely to have been considered unwanted. Though association between
high fertility and socio-economic status amplifies the
disadvantages, being born at high order is a mortality disadvantage
at all levels of parental wealth and education.

The relationship between family size including the sib-
ship size and the risk involved in the health status have been more
or less confirmed in a cross national study (Omran and Standley, 1976). Family size was highly associated with infant mortality (Mahadevan et al., 1985). Knodel and Hermalin (1983) confirmed that sib-ship size is more important correlate of infant mortality than birth order. Ramanujam (1991) found that number of children was significantly associated with post-neonatal mortality in one rural area of Tamil Nadu. But the association was not significant in another rural area of Tamil Nadu. In another study, he (1988) found that the number of living children was significantly associated with neonatal mortality among Scheduled Castes and other Hindus, and significantly associated with post-neonatal mortality among Scheduled Castes in rural areas of Tamil Nadu.

1.10. INTERVENTIONS

Depending upon the economic conditions, developmental status, political set up and prevalence of disease, several types of intervention programmes have been introduced in the developed and developing countries to control mortality. An important feature of the various developmental efforts in the past quarter century has been the priority assigned to the health sector in national strategies. Some developing countries have placed great importance on radical improvements in the social conditions of their population, in particular with regard to education and health promotion and protection, and an equal access to them. On the other hand, countries have also acted on the assumption that the best strategy for raising living standards and meeting the basic needs of
the population (such as education, health, sanitation) was to expand economic growth, the benefits of which would in time 'trickle them'. One review of mortality condition in South and East Asia concluded that there was no evidence to suggest that substantial progress in the health status of a population had been achieved in the absence of economic development (Preston, 1978). Even in the case of Kerala, where the progress in social development, as reflected by gains in education and literacy and increased political participation, has been cited as the principal factor underlying mortality declines this development is, in turn, the consequence of equity considerations which have led to a more equitable distribution of land and income, higher productivity and economic output, and better nutrition (Ratcliffe, 1978; Diaz-Briquets, 1985; Meegama, 1982). In South and East Asia, at least, it would appear that where policies of social equity have been pursued their impact on the health sector has been more efficient, or, at worst, not less efficient than the alternatives (World Bank, 1982).

The 'success stories' of mortality decline in China, Costa Rica, Cuba, Kerala and Sri Lanka, though repeatedly told, have not yet provided a full explanation of the processes which led to the rapid mortality transition (Ratcliffe J., 1978; Diaz-Briquets, 1985; Meegama, 1982; Bannister et al., 1981). There are, however, strong indications that much of the credit belongs to an emphasis on comparatively simple preventive measures, health education, and
delivery of services to the doorstep of households in rural areas. However, to what extent the lessons learned can be transferred to countries with different socio-political structures remains unclear (Blendon 1979).

Costa Rica has undergone a dramatic reduction in its infant mortality from 68 per 1000 live births in 1970 to 20 per 1000 in 1980. Although socio-economic development and greatly reduced fertility contributed to the infant mortality decline, as much as three-fourths of the decline is attributable to public health programmes implemented during the 1970s. The extension of primary health care - especially rural and community programmes, vaccination, community participation, and environmental sanitation - seems to be responsible for 40 per cent of the reduction. In addition, health services produced a notable decrease in the socio-economic differentials related to children's risk of death. The unique achievements of this developing country offer a new strategy for public health improvement (Rosero - Bixby, 1986).

An inter-state study of variations in infant mortality in rural India (Gunasekaran et al., 1988) concluded that MCH programmes with greater worker - population ratio would possibly have decremental effect on neonatal death rate and investments in medical care by way of more outpatient clinics and improved rural water supply programme would help reduce the infant mortality levels. The analysis suggests the need for a special programme for
Scheduled Caste children who seem to be more vulnerable than others.

Among several interventions launched over the past two decades, the relative importance of nutrition intervention efforts is worth examining. The importance of malnutrition as a contributing cause of mortality and the interaction of malnutrition with other diseases have merged as clearly established findings from the Puffer and Serrano PAHO study, the Candelaria project, and research carried out at INCAP and elsewhere (Puffer et al., 1973; Heller et al., 1979; Rashmi et al., 1971; Uray 1978; Salomon et al., 1966; Gordon et al., 1964). Recognition of this, coupled with an appreciation of the alternate approaches and technologies available, leads to direct interventions on nutrition and health. Over the past 20 years a large number of longitudinal intervention studies in nutrition and health have been carried out in developing countries with the aim of either to test a set of hypotheses about the effect of the intervention or to demonstrate the feasibility of a particular type of nutritional and public health programme.

A significant reduction in infant and toddler mortality rates among children receiving enhanced nutrition and health services has been reported by Swaminathan (1971), Shankar (1962), and Gopalan (1958). The project Poshak integrating nutrition programme with maternal and child care services in 7 districts of Madyapradesh in India revealed that a decreased mortality in the
intervened group of children (6 to 36 months of age) compared to the age-matched controls, but the difference was not statistically significant (Tara Gopaldas et al., 1975).

The Integrated Child Development Scheme (ICDS) started in India with the aim of providing health, nutrition and preschool education services as a package to the children below the age of 6 years has completed 10 years on 2nd October, 1985. Initially it was started in 33 projects and got expanded to 1354 projects. The infant mortality rate was reduced to 88.2 per thousand live births in ICDS projects during 1982-83 compared to national estimate of 110 in 1981 according to Sample Registration Scheme (Tandon, undated). Gurumurthy et al., (1987) investigated the ICDS project implemented in Chittoor district, Andharapradesh and found that the proportion of child survival was higher in ICDS area compared to non-ICDS area even after controlling the effect of variables like literacy level of women, occupation of mother, household income, belief on child birth and son preference.

Gwatkin et al., (1979) reviewed ten projects that tried systematically to reduce infant mortality and child mortality in poor rural areas. Majority of these projects included both nutrition and health components, but some did not. These projects were started at different points of time between in the mid-1950s and in the early 1970s. Results of these studies showed a decrease in infant and child mortality in the order of one third to one half,
sometimes more within one to five years of the project's initiation. The projects reviewed, point out a number of nutrition and health components that seem to work well, but the project experience would not support a dogmatic statement that any given component or combination of components works best under all circumstances. "The most effective projects seem to have featured a judicious mix of both nutrition and health components - a mix that has differed from place to place in response to dramatic difference in epidemiological, social, economic and political conditions" (Gwatkin et al., 1979). The experience gained from these projects also suggests that the mix will need to be varied according to the relative importance attached to different aspects of programme performance. The Narangval findings, for example, hint that nutrition interventions may be more effective in stimulating physical growth and reducing mortality at very early ages (particularly through maternal nutrition programmes). While medical interventions may in general be equally or more effective, and also more efficient, in reducing mortality among older children. Under such circumstances, the relative importance accorded to each component would depend on the priority attached to preventing the deaths of newborn babies relative to saving the lives of say, toddlers two to three years of age.

The projects reviewed here have demonstrated the feasibility and replicability of such experience. At present there is a need for field research with systematic experimentation and
evaluation focussing on the kinds of problems that will arise in programmes serving large populations on a continuing basis. Experimentation is also needed to find how primary nutrition and health care can be integrated with the more comprehensive basic needs programme that seem to offer the best approach for nutrition and health care efforts and promised impact on mortality with the main aim of demonstrating the impact of nutrition and health care programme significantly among the poor people in rural areas. Such sensitive changes and impact of nutrition and health programmes may not be visible with non-scheduled caste/scheduled tribes population. Therefore, it is necessary to assess the impact of nutrition and health care programmes on mortality among Scheduled Caste population. The Tamil Nadu Integrated Nutrition project implemented in Tamil Nadu which has an effective in-built health, nutrition, communication/education, nutrition monitoring and evaluation components provided a good opportunity to investigate the impact of health and nutrition intervention on infant mortality particularly among Scheduled Castes in rural areas with quasi-experimental design.