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The Impact of Rural-Urban Migration on Child Survival in India

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ABSTRACT

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The relationship between rural-urban migration and the mortality of migrant children is an area little studied in demographic research. Brockerhoff (1990) analysed Demographic and Health Survey data from several West African countries, and showed that child mortality rates of rural to urban migrant children are between that of rural and urban non-migrant children. Hence, in migrating to an urban area, migrants experience lower levels of child mortality than their rural origin, yet do not achieve the same low levels as those in their urban destination. It is suggested that this process is due to a combination of the selectivity of rural-urban migrants in terms of factors which predispose them to low levels of child mortality, and the failure of the migrant population to assimilate into their host urban society.

This thesis examines the impact that rural-urban migration has on child survival in India, and explores whether Brockerhoff's (1990) three-level relationship between migration and mortality can be applied to the Indian context. The Indian National Family Health Survey (1992) data is used for all 25 states of India, and logistic and multi-level logistic models are fitted for mortality outcomes in three periods: neonatal, early post-neonatal, and late post-neonatal / toddler. Models are fitted for north, south, and all-India with rural-urban migration as the key covariate of interest. The models control for socio-economic, bio-demographic, environmental, and health utilisation factors, and the clustering of cases within households and primary sampling units. Logistic models are used to examine the inter-relationships that exist between the determinants of child mortality, and to establish indirect routes through which migration status may influence child survival. In depth case studies were undertaken in Mumbai, examining the utilisation of maternal health care among rural-urban migrant and non-migrant groups. The results of these case studies are used to enhance the findings of the statistical modelling of mortality.

The results of the modelling of mortality show that, at the all-India level, migration status is not a significant determinant of mortality in any of the three periods analysed. However, the socio-economic status and use of maternal health care services of rural-urban migrants is between that of the rural and urban non-migrant groups, suggesting a three-level relationship between migration status and some of the determinants of child mortality. Hence, there are indirect routes through which migration status influences child mortality. In north India rural-rural migrants display higher odds of neonatal mortality than rural-urban migrants. The differences in socio-economic status and the use and availability of health services are suggested as the cause of this relationship. In south India urban-non migrants display lower odds of late post-neonatal and toddler mortality than rural-urban migrants. Differences in socio-economic and environmental conditions within urban areas are suggested as the main cause of mortality differentials between urban non-migrants and rural-urban migrants. The case studies suggest that social networks are an important factor in the assimilation of rural-urban migrants into their new environment, and can lead to increased knowledge and utilisation of maternal health care services. This research suggests that the relationships evident between rural-urban migration and child mortality in India are too complex and varied to be explained by Brockerhoff's (1990) three-level relationship between migration and mortality.

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Chapter 1 - Introduction

1.1 Introduction

The relationship between rural-urban migration and child survival is an area little studied in demographic research. In contemporary developing nations, population mobility, in the form of rural-urban migration, has been increasing rapidly since the 1960s (Mehta 1990). This "shaking loose of people" (Zelinksy 1971) in the developing world is the product of a number of factors, of varying magnitude and direction, including economic development, modernisation, cultural, social and political change, and government policy. Migration in the developing world has increased not only in scale, but in the diversity of groups involved, and migration itself has become increasingly more diverse in the nature of its spatial patterning (Hugo 1994). The increase in rural-urban migration has occurred in an environment of high rates of infant and child mortality (UN 1992). Distinct rural-urban differentials have been identified in the risk of infant and child mortality, with rural areas consistently associated with higher rates of mortality. Migration is, therefore, occurring between two distinct mortality regimes. However, although migration has been linked to fertility (Sharma 1991), a similar link has not been identified between rural-urban migration and child survival, thus migration status is generally not included in the group of causal factors known to influence mortality. This thesis examines the relationship between rural-urban migration and child mortality, detailing the influence that migrating between rural and urban areas has on the survival prospects of migrant children.

1.2 Background

A review of the literature surrounding the relationship between rural-urban migration and child mortality of migrants found a lack of literature in this area of demographic research. Literature from other academic fields, including biological anthropology and medicine, can provide a view of the potential nature of the migration and child mortality relationship, although their use in establishing the demographic impact of migration on child survival in India is limited. The work of Brockerhoff (1990;1994;1995) constitutes the only previous demographic studies of migration and child survival in the developing world. Using Demographic and Health Survey data aggregated from several West African countries, Brockerhoff discovered a significant relationship between rural to urban migration and the survival prospects of infants and children of migrants. A three level relationship emerged between migration and mortality. The highest child mortality risks were found among the rural non-migrant population, and the lowest risks among the urban non-migrant population. The child mortality of the migrant population was found to be between that of the rural and urban non-migrant populations. This relationship between rural-urban migration and child mortality was attributed to two processes: the selectivity of migrants with characteristics which predispose them to low levels of infant and child mortality relative to rural non-migrants, and the failure of the migrant population to assimilate into their new urban environment. Hence, although migrants have lower levels of child mortality than those in their rural origins, they do not achieve the same low levels of child mortality experienced by urban non-migrants.

Migration literature has consistently reported that India is immobile in terms of its levels of rural to urban migration (Skeldon 1986; Mehta 1990; Singh 1992). The migration system in India has traditionally been dominated by short distance rural to rural moves at the intra-district level, which account for over 60% of all migrations (Mehta 1990). However, the past two decades have witnessed an evolution in India's migration system, with the increasing importance of rural to urban migration. Between 1970 and 1990 the percentage of rural migrants with an urban destination doubled from 21% to 40% (Patil 1993). However, relative to other contemporary developing nations, the overall level of urbanisation in India is still low, with only 25% of the total population living in urban areas (Indian National Family Health Survey 1992). As a result of increasing urbanisation, over 200 million people now live in the cities of India, 30% of which are living below the poverty line (Selvaraj and Rao 1993).

There exists a rural-urban dichotomy in the survival prospects of infants and children in India. The Indian National Family Health Survey (1992) reports that the infant mortality rate in urban areas was 56 per thousand live births, much lower than the rural rate of 85 per thousand live births. Similarly, the under-five mortality rate of urban areas at 74 per thousand live births is lower than the rural rate of 120 per thousand live births. Previous studies suggest that this dichotomy is a product of a combination of the differing child care practices, reproductive behaviour, and socio-economic conditions in urban and rural areas of India, and the differential access to health services between urban and rural areas (Gandotra, Das and Day 1982; Jain 1979).

1.3 Aims of Thesis

Given the presence of a clear urban-rural differential in infant and child survival in India, and the growth of the rural-urban migration stream in India's migration system, the primary aim of this thesis is to establish the impact that migrating between rural and urban areas has on the survival prospects of migrant children. The survival outcomes of migrant children are contrasted with those remaining in rural and urban areas, to assess whether the mortality of migrants is significantly different to non-migrants. This thesis will also examine whether Brockerhoff's (1994) three-level relationship can be applied to the Indian context. The Indian National Family Health Survey (1992) will be used to examine the relationship between rural-urban migration and child mortality.

This research focuses on mortality to children under the age of two years, and examines other determinants of under-two mortality, apart from migration status. Using previous literature on the determinants of infant and child survival in the developing world, this research will model under-two mortality in terms of the bio-demographic, socio-economic, environmental, health care utilisation, and geographic factors measured in the Indian National Family Health Survey (1992).

Previous literature has noted the multi-causal nature of infant and child survival in the developing world (Mosley and Chen 1984). In order to reflect this, the inter-relationships between the determinants of under-two mortality are modelled, to highlight the potential intervening pathways through which one set of factors may act to influence mortality outcomes. In addition, it is intended that this process will establish indirect routes through which rural-urban migration may have an influence on under-two mortality.

A focus of this research is the utilisation of maternal health services among migrant and non-migrant populations in India. Previous literature has noted that there exist two distinct patterns of health service use in India (Karnatikar and Sinha 1986). The rural pattern is characterised by low levels of ante-natal care utilisation and a reliance upon traditional home deliveries. In contrast, urban areas are marked by higher levels of both ante-natal care utilisation and childbirth in formal institutions. Given this, this qualitative aspect of this research will examine the impact that migrating between these two regimes of service utilisation may have on the health service use of migrants, and how this may have indirect consequences for the migration and mortality relationship.

Dyson and Moore (1983) note that a clear north/south dichotomy exists in India, with the northern states consistently displaying the poorest demographic indicators (high fertility and infant mortality, lower life expectancy, and low levels of literacy). This research analyses data from all 25 states of India, and thus provides the opportunity to further investigate the presence of a north/south divide in India's demography. In addition, state level variations in child mortality will be examined, and the differential impact of rural-urban migration on child mortality in the north and south of India will be investigated.

This research uses a combination of quantitative and qualitative methodologies to investigate the relationship between rural-urban migration and child mortality. Logistic and multi-level logistic models are applied to cross-sectional survey data collected under the Indian National Family Health Survey Programme 1992/93, to model the determinants of under-two mortality and assess the impact of migration status on child survival prospects. A logistic modelling methodology is adopted to examine the inter-relationships between the determinants of child mortality. A qualitative methodology is used to examine the utilisation of maternal health care services among migrants and non-migrants in Mumbai, India, and the influence that service utilisation may have on child mortality among migrant groups.

1.4 Structure of Thesis

Chapter 2 provides a review of recent levels and trends in infant and child mortality in India, in order to place the present mortality regimes in context. The literature surrounding the determinants of infant and child mortality in India is reviewed, to provide a theoretical foundation for the analysis of under-two mortality.

Chapter 3 reviews migration theory, which provide potential explanations for the patterns of migration observed in India. The growth of India's migration system is described, detailing the evolution of the rural-urban migration stream over the past three decades, and changes in the spatial distribution of the population. Chapter 3 also reviews the literature surrounding the relationship between migration and mortality. Literature from medical, historical, and biological anthropology backgrounds are reviewed, describing differing types of migration and mortality relationships that have been observed in previous studies. Previous demographic research on the influence of rural-urban migration on child survival is also reviewed, and is used as an indicator of the type of relationship that may be found between migration and child mortality in India.

Chapter 4 constitutes the first stage in the analysis of the relationship between migration and child survival in India. This chapter reviews the data sources available for investigating the relationship between rural-urban migration and child mortality, focussing on the Indian National Family Health Survey (1992) which constitutes the main data source for this research. The The preliminary analysis of the relationship between rural-urban migration and child survival is presented. The main focus of Chapter 4 is the logistic modelling of under-two mortality. This chapter describes the methodology used, the results found, and discusses these results in relation to the impact of rural-urban migration on under-two mortality.

Chapter 5 uses multi-level logistic modelling to examine the relationship between rural-urban migration and child mortality, in order to control for unobserved influences on child mortality. The multi-level methodology is described, and the results are presented with an emphasis on the differences observed in results between the logistic and multi-level logistic models. Separate analyses are performed for north and south India, and the results of these are contrasted with those observed at the all-India level. The impact of rural-urban migration on child survival is discussed for the north, south, and all-India models, and state-level variations in child mortality are investigated.

Chapter 6 highlights the multi-causal nature of under-two mortality, examining indirect routes through which rural-urban migration may influence mortality. Those variables which proved to be significantly related to under-two mortality in Chapters 4 and 5 are taken as the dependent variables, and logistic models are fitted in order to examine the inter-relationships between all the factors significantly related to under-two mortality. The analysis focuses on the relationship between migration status and the determinants of child mortality, and the factors responsible for creating child mortality differentials between migrant groups.

Chapter 7 examines the utilisation of maternal health care services among rural-urban and non-migrants in Mumbai, India, using a case-study methodology. The analysis focuses on the process of rural-urban migration and assimilation into the urban environment, and the influence this may have on the utilisation of maternal health care services. The chapter identifies a number of individual and household characteristics that are associated with the utilisation of prenatal care.

Chapter 8 summarises the results of the quantitative and qualitative research, and reviews the relationships observed between rural-urban migration and under-two mortality. This chapter presents conclusions and policy implications arising from the analysis, and suggests future areas of research in the relationship between migration and child mortality.

Chapter 2

Child Mortality in India:

Levels, Trends and Determinants

2.1 Introduction

This chapter reviews the literature surrounding infant and child mortality in India, in order to provide a theoretical foundation for this research. The current levels and recent trends in infant and child mortality are discussed, and the determinants of mortality as highlighted in previous empirical studies are reviewed.

2.2 Levels of Infant and Child Mortality

Thirty percent of all deaths in India occur to those aged less than one year, and deaths in the age group 0-4 years account for 47% of the total number of deaths (Padmanabha 1982). In terms of it's infant and child mortality levels, India is currently ranked thirty-sixth in the United Nations table of 128 developing nations (Jain and Visaria 1988), with an IMR (Infant Mortality Rate) in 1992 of 78.5 deaths per thousand live births (INFHS 1992). The level of child mortality is estimated at 33.4 deaths per thousand live births (INFHS 1992).

The rates of both infant and child mortality have declined continuously since the beginning of the twentieth century, when the rate of infant mortality was 215 per thousand live births (Indian Office of the Registrar General 1971). However, the rate of decline in both infant and child mortality since then has been sporadic, the greatest decreases have been witnessed in the past three decades. Throughout the first four decades of the century the rates of infant and child mortality declined slowly, with famines, pestilence and the Great Plague acting to maintain the high levels of mortality. By 1941 the IMR was 161 per thousand live births and the CMR (Child Mortality Rate) was 142 per thousand live births (Indian Office of the Registrar General 1971).

By 1970 the infant mortality rate in India had declined to 120 per thousand live births, and the Indian government introduced the goal of reducing this by 50% by the year 2000. The programmes introduced by the Indian government to reduce infant and child mortality are described in section 2.4. Since 1978 the rate of decline in the levels of both infant and child mortality has increased, by 1985 infant mortality had fallen to 85 per thousand live births, a decrease of over 30% since the introduction of the first government scheme to actively reduce mortality in 1978 (UN 1992). However, since then the pace of mortality decline has once again slowed, with only a 10% reduction in infant mortality in the past decade (INFHS 1992).

The distribution of the risk of infant and child mortality is non-uniform across India. The level of both infant and child mortality is much higher in rural areas, with rates of 85.0 per thousand live births (IMR) and 37.6 per thousand (CMR), compared to urban rates of 56.1 per thousand live births (IMR) and 19.6 per thousand live births (CMR) (INFHS 1992). This rural - urban dichotomy in child mortality is evident in each of the 25 states. National level estimates of mortality hide wide state level variations, with the northern states having considerably higher rates of both infant and child mortality than their southern counterparts. Table 2.1 displays the infant and child mortality rates for each state of India (INFHS 1992), and Figure 2.2 displays a map of the states of India. It is apparent that the highest rates are found in the northern states of Orissa, Uttar Pradesh, and Bihar. The lowest rates are found in the southern States of Goa and Kerala, and in the small north-eastern States of Mizoram and Nagaland.

Dyson and Moore (1983) suggest that such state-level variations in mortality are due to a combination of variations in the level of female literacy, which affects mortality through the association between increased education and the access to formal health services, and the differing kinship structures which influence the level of female autonomy. An alternative explanation is offered by Nag (1983) who argues that it is the level of social development and political awareness in a state that acts to influence the level of infant and child mortality. It is argued that West Bengal with it's high levels of industrial productivity has higher levels of mortality than Kerala, a state which although economically inferior, has a superior infrastructure of social institutions aimed at promoting health care.

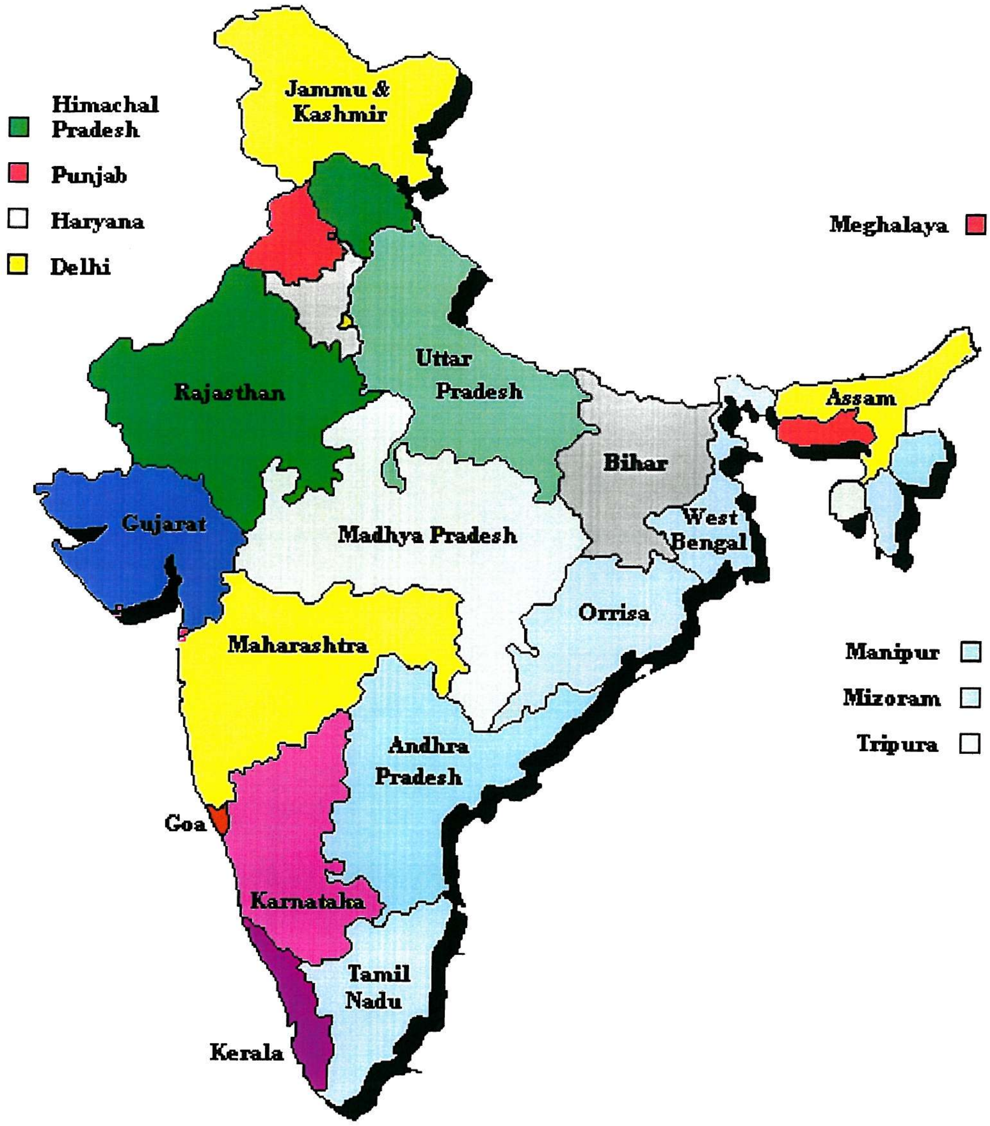
It is interesting to note from Table 2.1 that the highest levels of child mortality are not found in those states that have the highest levels of infant mortality. Assam has the highest child mortality rate at 58.7 per thousand, yet is ranked fourth in terms of it's level of infant mortality. Arunchal Pradesh has relatively low infant mortality, yet has a child mortality rate of 33.3 per thousand, much higher than states with similarly low levels of infant mortality. Bhatia (1989) notes that early infant deaths are associated with the biological characteristics of the mother and with factors relating to health care utilisation during pregnancy and child birth. Deaths to children, however, are associated with characteristics of the child's socio-economic and physical environment. The disparities between the states in the ranking of infant and child mortality suggests that the distribution of risk factors for both types of mortality are non-uniform across the states. This indicates that the factors determining infant and child mortality may vary between states, and hence the states are not homogenous in terms of their risks of infant and child mortality. Given this, it may be expected that the analysis of the determinants of infant and child mortality will highlight not only state level variations in mortality, but also the differing importance of the determinants of mortality in the states. In addition, given the variation in the levels of rural-urban migration between states (see Chapter 3), it seems plausible to suggest that the influence of rural-urban migration on child mortality may differ between states.

Table 2.1 Infant and child mortality rates (per thousand live births) by state 1992/93

State	Infant Mortality (0/00)	Child Mortality (0/00)
Orissa	112.1	21.3
Uttar Pradesh	99.9	46.0
Bihar	89.2	42.0
Assam	88.7	58.7
Madhya Pradesh	85.2	49.3
Tripura	75.8	31.2
West Bengal	75.3	26.0
Haryana	73.3	27.4
Rajasthan	72.6	32.3
Andhra Pradesh	70.4	22.4
Gujurat	68.7	37.9
Tamil Nadu	67.7	20.1
Karnataka	65.4	23.5
Delhi	65.4	19.0
Meghalaya	64.2	24.3
Himachal Pradesh	55.8	14.1
Punjab	53.7	15.0
Maharashtra	50.5	20.9
Jammu and Kashmir	45.4	14.3
Manipur	42.4	20.2
Arunchal Pradesh	40.0	33.3
Goa	31.9	7.2
Kerala	23.8	8.4
Nagaland	17.2	3.6
Mizoram	14.6	14.9
Total	78.5	33.4

Source: Indian National Family Health Survey 1992: All India Report. P208 & P211

Figure 2.1: Map of Indian States



2.3 Causes of Infant and Child Mortality

This section details the main causes of infant and child mortality in India, in order to provide an understanding of how the proximate determinants of mortality (outlined in section 2.5) result in a child death. The causes of mortality in the neonatal period are very different from those observed in the post-neonatal and child age groups, reflecting the changing determinants of mortality with the age of the child (Bhatia 1989). Neonatal deaths are associated with the environment experienced by the foetus in the womb, the health status of the mother during pregnancy, and the conditions surrounding the birth of the child. Deaths to children in the post-neonatal and child age groups are associated with the characteristics of the physical and social environment in which they are raised (Bhatia 1989).

The W.H.O (1986) report that the exact causes of neonatal death are difficult to establish, especially in resource poor environments where medical facilities are limited. The most common cause of neonatal death in India is neonatal tetanus (Luther 1998), the result of infection during pregnancy or at birth. Neonatal tetanus is often related to unhygienic delivery practices, however, it may also arise from infections of the amniotic fluid or the umbilical cord following prolonged labour. Infections caught during labour may also lead to neonatal pneumonia, also a major cause of neonatal death in India. The two most effective methods for limiting the number of neonatal deaths caused by infections are to encourage hygienic delivery practices through the training of traditional birth attendants, and to provide two doses of tetanus toxoid injections during pregnancy which lead to the passive immunization of the foetus.

Neonatal death may also be caused by problems experienced during labour, including birth trauma and asphyxiation. Deaths caused by birth trauma are often the result of prolonged labour due to insufficient uterine contractions, disproportion between the foetus and the pelvis, malposition of the foetus, or detachment of the placenta (WHO 1986). In addition, birth or intrauterine asphyxiation may occur due to decreased oxygen supply through the placenta before or during labour. These causes of death are often associated with the skills of the person conducting the delivery, such that improved training for traditional birth attendants on the rudiments of midwifery and the handling of difficult deliveries could act to significantly reduce the number of neonatal deaths. The W.H.O (1986) report that many of the risk factors for birth trauma and asphyxiation can be identified in pregnancy through the monitoring of foetal growth, and thus recommend that prenatal care is provided to all pregnant women to highlight those most at risk of experiencing problems during labour.

Low birth weight is estimated to account for 32% of all neonatal deaths in India (WHO 1986). Low birth weights result in an increased susceptibility to infection and a vulnerability to the loss of body heat, such that hypothermia is a major contributing cause of death among low birth weight babies. Low birth weight is closely linked to maternal malnutrition, although other factors such as high blood pressure, infection (especially malaria and sexually transmitted diseases), and prematurity (often caused by mothers working in labour intensive employment during pregnancy) are also contributory factors.

Deaths to those in the post-neonatal and child periods are associated with exogenous factors, which include the characteristics of the physical and social environment in which the child lives (Bhatia 1989). The main causes of death in these periods in India are acute respiratory tract infections, diarrhoea, and infectious diseases (INFHS 1992). The most prevalent acute respiratory tract infection is pneumonia, the INFHS (1992) reports that 7% of all children in the sample displayed symptoms of pneumonia in the two weeks prior to the survey. However, death from pneumonia is preventable through early diagnosis and the provision of antibiotics. The INFHS (1992) reports that acute diarrhoea is the main cause of post-neonatal and child death. Deaths from acute diarrhoea are most often due to the dehydration that results from the loss of water and electrolytes (Black 1984), and nearly all diarrhoeal deaths can be prevented by the prompt administration of oral rehydration solutions. The most prevalent infectious diseases among children in India are tuberculosis, diphtheria, pertussis, tetanus, poliomyelitis, and measles, all of which are preventable through immunization.

2.4 Policies to Reduce Infant and Child Mortality

This section details the programmes introduced by the Indian government to reduce infant and child mortality, in order to provide some background to the facilities available for the prevention of child mortality and morbidity. In 1979 the UN World Health Assembly endorsed the Alma Ata declaration on primary health care and encouraged member states to formulate comprehensive health polices and strategies to reach the target of health for all by the year 2000 (Kurup 1992; WHO 1986). At this time the infant mortality rate in India was 120 per thousand live births, and the Indian government introduced the goal of reducing this by 50% by the year 2000.

The process of reducing infant and child mortality began with the 1978 Expanded Programme of Immunization (EPI) (Talwar 1995). The objective of the programme was to reduce the morbidity, mortality and disability in infants and children caused by tuberculosis, diphtheria, pertussis, tetanus, poliomyelitis, and measles, by providing free vaccinations to all children. The programme began with a scheme to immunize children against poliomyelitis in 1978, and the provision of tetanus toxoid vaccinations for children and pregnant women was added in 1980. This was followed by the inclusion of the BCG vaccination in 1981, and finally the measles vaccination in 1985 (INFHS 1992). In 1985 the EPI was renamed the Universal Immunization Programme (UIP), and the Indian government declared it's mission of vaccinating at least 85% of all infants by 1990 against the six vaccine preventable diseases (Ministry of Health and Family Welfare 1991). Although the programme was initially introduced on an experimental basis in a small number of districts, by 1990 the programme had expanded to cover all districts in India (Talwar 1995). The programme aimed to provide vaccinations through local health workers, and provides health education at the community level in order to encourage the uptake of immunization. The Indian National Family Health Survey (1992) reports that only 35% of children in India are fully vaccinated, and 35% have received some vaccinations, thus 30% of children have not received any vaccinations. The uptake of immunization varies considerably, with 62% of infants receiving the BCG vaccination and only 42% vaccinated against measles. The continuation rate from the first to the third dose of the DPT and polio vaccines indicates considerable dropout (22% in DPT and 20% in polio), thus although a high percentage of infants are receiving the first doses of the DPT and polio vaccinations they are not vaccinated against the diseases unless they receive the full three doses.

At the same time as the launch of the EPI the government of Indira Ghandi announced a twenty point programme of high priority goals for the development of the Indian economy during the sixth and seventh five year plans. Among the main priorities was a rapid improvement in the conditions of women and children (Jain and Visaria 1988). The instruments for this goal came in the range of child health schemes introduced by the Indian Government during the 1980s. The first of these was the Integrated Child Development Scheme (ICDS) launched in 1975, which aimed to provide health services and nutritional supplements to children under six and pregnant and lactating women, and health education to mothers.

The scheme provides health services through local health workers (*anganwadis*) and integrates several health and nutritional programmes in order to provide a comprehensive health service for mothers and children. In addition, the ICDS aims to promote the utilisation of health services through the dissemination of health education in the local community (National Institute of Nutrition 1992). The ICDS targets malnutrition in children and pregnant women by providing supplementary feeding at anganwadi centres, and provides vitamin A supplements in order to prevent nutritional blindness in children. Anganwadi centres also provide services for the monitoring of child growth, in order to screen children for signs of malnutrition. Education on nutrition is provided to mothers and advice on dietary requirements during illness and pregnancy is provided. The Oral Rehydration Therapy Scheme was incorporated in the ICDS in 1986, and aims to prevent deaths due to diarrhoea through the provision of oral rehydration salts and information on the management of diarrhoeal diseases.

The National Anaemia Prophylaxis Programme is incorporated into the ICDS, with the aim of providing all children between 6 and 12 months of age and all pregnant and lactating women with iron and folic acid supplements for the prevention of anaemia. Anganwadi centres also aim to provide antenatal care check-ups, and provide nutritional advice for pregnant mothers, to prevent low birth weights and highlight complications during pregnancy. The centres provide the facilities to treat minor ailments in both women and children, and a referral system is in operation whereby medical cases requiring more specialised advice are referred from the anganwadi centre to the primary health centre or district hospital. The ICDS was initiated in 33 districts on an experimental basis, and it has gradually expanded throughout the country such that it now covers 2424 districts (Kurup 1992). The success of the expansion of the ICDS has lead to a growth in similar projects in individual states, the school mid-day meal programme and the Composite Programme for Women and Pre-school Children (CPWP) both concentrated on improving nutritional status through dietary supplementation, and are among the most successful.

2.5 Determinants of Infant and Child Mortality

This section reviews the literature surrounding the determinants of child survival in India, in order to provide a theoretical foundation for the statistical analysis of mortality. Child mortality in the developing world is the product of a complex of factors associated with the physical and socio-economic environment into which the child is born. Frameworks have been established in demographic literature in an attempt to conceptualise these multiple factors. Mosley and Chen (1984) combine the traditional medical and social science approaches to mortality, and argue that the survival probability in any society is due to the operation of social, economic, biological and environmental forces. A framework is proposed in which all social and economic variables must operate through a set of proximate determinants in order to influence child survival. The proximate determinants are categorised as: maternal factors, environmental characteristics, nutrition, injury, and personal illness control. It is argued that the socio-economic influences on mortality operate at three distinct levels: individual, household, and community, such that an environment of social synergy is created in which the influences on the proximate determinants of mortality are multiple and often inter-related (Jain 1988).

Given this, the determinants of child mortality can be broadly categorised as: bio-demographic, socio-economic, environmental, community, and health service related. However, the influence of each of these sets of factors differs with the age of the child, with mortality at earlier ages more dependent upon biological factors, and a shift towards the influence of the socio-economic and physical environment as the child enters the post-neonatal and toddler stage (Bhatia 1989). This section will review the importance of each of these sets of factors in determining child survival in India. The determinants of mortality are discussed under the broad categories of bio-demographic, socio-economic, environmental, cultural factors and urban-rural residence, in order to reflect previous literature that has categorised determinants in a similar way. In addition, health service related factors are used, as a particular focus of this research is the utilisation of health services by migrant and non-migrant groups. This method of categorisation of the determinants of mortality will be utilised throughout the analysis. The potential for migration status to be used as a determinant of mortality is discussed in Chapter 3.

2.5.1 Urban and Rural Residence

The Indian National Family Health Survey (1992) highlighted the presence of urban - rural differentials in both infant and child mortality in India. In urban areas the rate of infant mortality was found to be 56.1 per thousand live births, and the child mortality rate to be 19.6 per thousand live births. The levels of both infant and child mortality were found to be higher in rural areas, with an infant mortality rate of 85.0 per thousand live births, and a child mortality rate of 33.4 per thousand live births (INFHS 1992). This urban - rural dichotomy in the risk of infant and child mortality is due to the unequal distribution of the risk factors for mortality between urban and rural areas.

Standards of living, as indicated by household environmental conditions, display considerable variation between urban and rural areas. The INFHS (1992) showed that 60% of those living in rural areas lived in kaccha housing, and 10% of the rural sample lived in houses with more than five people per room. In addition, rural areas were characterised by a lack of formal sanitation facilities, with only 7% of the rural sample having a flush toilet within their house, and 75% relying upon non-piped water for bathing and drinking (INFHS 1992). In contrast, urban areas displayed indicators of a higher standard of living than that found in the rural areas. Only 17% of the urban sample were residing in kaccha housing, with 52% in pucca housing. Sixty percent of the urban sample had a flush toilet in their home, and 69% had access to a source of piped water source (INFHS 1992). Given that previous studies, as outlined in Section 2.5.4, have shown environmental conditions of the household to be significant determinants of infant and child mortality, it may be suggested that the presence of indicators of inferior conditions in rural areas may act to create an urban - rural differential in infant and child mortality.

Section 2.5.6 highlights the importance of the utilisation of maternal health services in determining the survival prospects of infants, and any differences in the utilisation of services between urban and rural areas may act to create mortality differentials. Literature suggests that there exist two distinct patterns of service use in India (Archarya and Kanitkar 1994). The rural pattern is characterised by low levels of utilisation of ante-natal care and a reliance upon home births by dais. Urban populations, however, display higher levels of ante-natal care utilisation and a greater use of formal institutions for child birth. The INFHS (1992) showed that only 45% of those in rural areas received some form of ante-natal care, compared to 77% in urban areas. This differential uptake of services may be the product of two sets of factors. Firstly, disparities in the availability of services between urban and rural areas reduce the access that rural populations have to maternal health care services (Kapil 1989). Secondly, the differing attitudes and knowledge of rural and urban populations to the potential benefits of antenatal care will have an influence upon the levels of uptake in urban and rural areas. Karnatikar and Sinha (1989) report that rural populations often lack knowledge on the availability of services, and possess a general sense of apathy towards seeking health care during pregnancy. Their urban counterparts, in contrast, are noted to be more forward thinking in their attitudes to service utilisation, a product of the increased availability of services in urban areas and the exposure of women to society outside the traditional domestic home.

The INFHS (1992) showed that 73% of females sampled from rural areas were illiterate, compared to only 37% of their urban counterparts. In addition, 10% of the urban sample had reached levels of education beyond primary level, compared to less than 1% among the rural sample. Section 2.5.3 highlights the importance of maternal education as a determinant of infant and child mortality, suggesting that the participation in formal education increases the awareness of the availability and potential benefits of modern health services, and provides women with functional autonomy within the household.

Higher levels of education have been linked with an increase in the resources available to allow a household to provide access to health services and adequate nutrition for all family members. Given the demonstrated link between female education and infant mortality, disparities in the levels of female education between urban and rural areas may act to influence the creation of mortality differentials.

Karnatikar and Sinha (1989) discuss the differing attitudes towards the utilisation of maternal health care between rural and urban populations. It would seem plausible to suggest that such attitudinal differences are the product of the levels of education and variations in cultural and religious practices found in rural and urban areas. In addition, the differences in the availability of health services between rural and urban areas may act to create differing attitudes towards the utilisation of health care. The exposure to health services in urban areas may lead to greater knowledge of the health benefits that they offer, and in turn may encourage urban women to utilise health services.

This section has highlighted the presence of urban-rural differentials in infant and child mortality in India. It is apparent that each of the previously discussed categories of mortality determinants show an unequal distribution between urban and rural areas, with the highest risk factors for mortality concentrated in rural areas. As suggested by the frameworks of Mosley and Chen (1984) and Jain (1988), the factors influencing infant and child mortality are not independent of each other, but are inter-related. Therefore, within both urban and rural areas, the factors influencing infant and child mortality act synergistically to produce distinct urban and rural mortality regimes. The effects that the migration between the regimes has on child survival prospects is discussed in Chapter 3.

2.5.2 Bio-demographic Factors

A mother's age at the birth of her child has been shown to have an influence on the survival prospects of that child, with higher mortality associated with children born to young mothers (aged less than twenty) and older mothers (aged over thirty-five) (Ladislav 1972 ; Nortman 1974). This U-shaped relationship between maternal age and infant mortality is hypothesised to be the result of biological immaturity at younger ages and the declining efficiency of the reproductive system at older ages, reducing the biological capacity to produce strong normal weight babies (Madise and Diamond 1995). In a study of rural Karnataka, Badari (1983) found that the lowest rates of both neonatal and post-neonatal mortality were found among the age group 30-34 years, suggesting that the biological conditions of mothers recently attaining menarche and those approaching menopause appear to have adverse effects on infant survival. It was discovered that neonatal rates of mortality were lower among the 15-19 age group than in the 20-24 age group. This result was ascribed to the prevailing custom of young mothers to return to their natal home for the delivery of their first child, where they benefit from the child care experience of their mothers. This result indicates the importance of individual behaviour in modifying the potential biological correlates of child survival. The average age at marriage for females in India is 20 years (INFHS 1992), whilst approximately 50% of all women aged 20-49 had their first birth at age 15-19. Thus, the cultural norms of early marriage and childbearing present in the social environment of India results in a large proportion of the female population exposed to factors associated with an increased risk of infant mortality.

Birth order has been shown to have a significant influence on the survival prospects of infants (Sandhya 1991). In a study of infant mortality in Gujurat, Gandotra, Das and Dey (1982) found that the lowest risks of infant mortality were found among second order births, and the highest risks among first births and those of higher parity (over four). The explanation for this U-shaped relationship lies in the correlation between parity and mother's age, with both first births and higher parities occurring at high risk maternal ages. Badari (1983), in a study of rural Karnataka, found that the proportion of neonatal deaths to infant deaths declined with birth order, and hypothesised that the child care experience gained with parity increased a mother's ability to care for the neonate. In addition, parity may have an influence on infant mortality independent of the effects of mother's age. Zenger (1993) suggests that high parity results in competition between siblings with similar needs, influencing the survival prospects of both the younger and elder sibling. This process is exacerbated in low income families, where scarce resources are shared among a large number of children.

Low birth weight has been identified as a major determinant of infant mortality, resulting in a diminished immune system and increased susceptibility to infection, and is particularly associated with an increased risk of neonatal death (Belsey and Royston 1987). Low birth weights are the product of a number of factors, including prematurity, mother's nutritional status, utilisation of antenatal care, and mother's age at birth. Hence, each of these factors in turn becomes a determinant of infant mortality due to it's correlation with low birth weight. Multiple births may also result in low birth weights, particularly in an environment of poor nutritional intake, and thus are also identified as a risk factor for infant mortality. A further risk associated with multiple births is the increased chance of complications during delivery, particularly if the delivery takes place in a non-medical setting (Gandotra, Das and Dey 1982).

Breast feeding has been shown to provide a natural immunity to infection and a valuable source of nutrition, and the failure to breastfeed may thus be considered as a major determinant of infant mortality. Rama Rao and Pandey (1994) note the presence of a U-shaped relationship between the duration of breast feeding and infant survival in Goa. It was discovered that the average duration of breast feeding was two years, with much shorter durations evident among the urban poor. This urban-rural differential was also evident in Gujurat (Gandotra, Das and Dey 1982) and is attributed to differences in female labour force participation between urban and rural areas, with the working conditions in urban areas incompatible with the continuation of breast feeding. It has been noted that exclusive breast feeding of durations over six months may have detrimental effects on the survival prospects of the child (Rama Rao and Pandey 1994). Although breast feeding provides a valuable source of nutrition, as a child grows it's nutritional demands increase beyond that provided by breast feeding, hence exclusive breast feeding for long durations may increase the risk of malnutrition.

Hobcraft, McDonald and Rutstein (1984) analysed World Fertility Survey data for 26 countries and suggested that the main causative factor underlying high rates of infant mortality was the short spacing between births. Srivastava (1990) highlights the detrimental effects of short birth spacing on infant survival in rural Uttar Pradesh, where the infant mortality rate for those with birth intervals of less than two years was 219 per thousand live births, compared to a rate of 40 per thousand live births for those with spacings of over three years between children. Similarly, Sweemar (1984) found that the infant mortality rate in Punjab was three times greater among those with birth intervals less than two years when compared to those with intervals over three years. It is suggested that the influence of birth spacing on infant survival exists irrespective of maternal age, parity and socio-economic status (Trussell and Hammerslough 1983), and that the biological consequences can have an influence on health status throughout the childhood years (Maine and McNamara 1985).

Two possible mechanisms are suggested to explain the relationship between birth spacing and infant mortality. The maternal depletion syndrome postulates that repeated pregnancies and short birth spacing results in a mother's inability to recover physically and nutritionally from pregnancy, thus increasing the probability of producing premature or low birth weight babies, characteristics which are associated with increased risk of mortality (Srivastava 1990). Alternatively, it is suggested that short birth spacing increases the competition for resources between closely spaced siblings with similar needs, thus influencing the survival prospects of both the younger and elder sibling (Zenger 1993). Evidence from India suggest that biological depletion is the main mechanism through which short birth intervals influence infant survival. Srivastava (1990) showed that in rural Uttar Pradesh the impact of short birth spacing was not altered when the preceding child had died, suggesting that competition between siblings is not the cause of mortality. In addition, the impact of short birth spacing on mortality was at a maximum when the mother had started child bearing aged less than eighteen, suggesting that biological depletion caused by the commencement of reproduction at a immature physical age increased the impact of the short birth spacing on subsequent infant survival.

The neonatal mortality rate in Karnataka was found to be 50% higher among women who had experienced a previous stillbirth, and 10% higher among those who had experienced a previous spontaneous abortion (Badari 1983). It is suggested that the relationship between previous child loss and the risk of mortality to the index child may be the result of chronic malnutrition of the mother, depleting the efficiency of the reproductive system, and resulting in low birth weight babies. Alternatively, the presence of a previous child death may indicate a history of genetic disorders, which will continue to effect subsequent births.

It is suggested that the presence of child mortality may act to increase fertility though the process of child replacement and child ensurement (Preston 1978; El Deeb 1988). Child replacement refers to the practice of replacing a child that has died with another birth, whereas child ensurement describes the act of having a large family size in an environment of high infant mortality, in order to ensure that enough children survive to act as social support for the parents at older ages. It is suggested that both of these practices may influence child mortality by increasing the number of births a woman has, in turn increasing the risk of maternal depletion. Symala and Roy (1994) found that the net effect of replacement and ensurement in Goa was the addition of 2.2 children to the average family size, and that the family size was higher if the mother had experienced the loss of a son. However, in a study of Andhra Pradesh, Lakshmamma and Reddy (1991) found that 89% of women interviewed did not think that either child replacement or ensurement were necessary. These differences have been attributed to the differing economic importance of children between states. Andhra Pradesh and Maharashtra have a system of credit co-operatives and public relief employment schemes in rural areas which reduce families economic dependency on children (Cain 1981).

In India the infant mortality rate for males is presently 88.6 per thousand live births, compared to a rate of 83.9 per thousand live births for females (INFHS 1992). This lower rate for females is a product of the biological superior stamina of the female child (Jain 1979). However, this situation is reversed at later ages, with a female child mortality rate of 42.0 per thousand live births compared to a male rate of 29.4 per thousand live births (INFHS 1992). This reversal in the survival advantage of the female child is attributed to the cultural status of women in Indian society, which it is suggested may act to produce sex-biased behaviours and practices that discriminate against the female child (Chen et al 1981). The Indian National Family Health Survey (1992) explains this sex differential in mortality through the relative nutritional and medical neglect of the female child after breastfeeding has ceased, hence explaining the failure of excess female mortality to occur until later ages. The sex differentials in mortality are wider in rural areas and in the northern states. Dyson and Moore (1983) discuss the continuation of a North-South demographic dichotomy in India, with the northern states continuing to have poorer indicators of demographic performance (higher fertility and infant mortality). It is suggested that this is a reflection of the kinship structure of the northern states, which acts to inhibit female autonomy, and thus reduce access to health services. It is suggested that the relatively lower status of women in northern states may act to create an environment in which the female child is less valued than the male child, resulting in the preferential distribution of resources towards the male child (Basu 1990). In addition, the low levels of female autonomy in northern states may result in women being less able or prepared to utilise modern medical facilities for themselves or their child, thus increasing the risk of child mortality (Dyson and Moore 1983).

A consanguineous marriage refers to a union contracted between persons biologically related as second cousin or closer (Bittles 1997). Consanguinity may influence mortality through the expression of rare recessive genes from a common ancestor. Genes that are rare in the general population can randomly increase to a high frequency in a breeding pool restricted to a few generations, due to the influence of random genetic drift (Bittles 1997). As a consequence, it is estimated that infant mortality is 1-4 % higher among consanguineous marriages than those between unrelated couples (Bittles and Markov 1988). In India uncle-niece marriages are the closest biological marital union legally permitted, although marriage between parallel first cousins is the most prevalent form of consanguineous marriage (Bittles 1997). The Indian National Family Health Survey (1992) showed that 11.9% of all marriages in India were consanguineous, with a higher prevalence among Muslims. North India has a generally low prevalence of consanguinity, where such marriage forms are restricted to pockets of the Muslim population. In the southern states consanguinity is much more prevalent, and exists among both Hindus and Muslims, with 41% of all marriages classified as consanguineous in Karnataka and Tamil Nadu (INFHS 1992). Krishnamoorthy and Audinarayana (1998) note that there has been a decline in the prevalence of consanguinity in Andhra Pradesh, Kerala, Tamilu Nadu and Karnataka during the past two decades. It is suggested that a recent increase in dowry payments reflects the tendency for males to move away from consanguineous marriages towards those that may bring greater dowry. However, given the continued high prevalence of consanguinity and it's noted influence on infant mortality, it may be suggested that consanguinity may be perceived as a potentially important biological determinant of infant and child mortality.

2.5.3 Socio-Economic Factors

Maternal education has been consistently highlighted as a major determinant of infant and child mortality in the developing world (Cleland 1990; Cleland and van Ginneken 1988). A strong negative association between the level of mothers education and the survival prospects of her children has been noted in many developing societies (Caldwell 1986; Caldwell and McDonald 1982). The largest effects of education on mortality are seen in the post-neonatal and toddler periods. Gandotra, Das and Dey (1982), in their study of rural Gujurat, found a fifty percent increase in the risk of post-neonatal mortality among illiterate mothers when compared to those who had reached the eleventh standard.

The explanations for the relationship between education and infant survival may lie within the strong educational differentials in the utilisation of maternal and child health care services that exist in India (Prasad 1997). Khandekar (1993), in a study of health service utilisation in Bombay, found that there was a positive correlation between the mothers perception of the need for maternal health care and her level of education. The uptake of child health care services has been shown to be greater among those with education above primary level in both rural and urban areas of India (Singh and Pawar 1983). However, the mechanisms through which maternal education act to influence the utilisation of health services, and subsequently child survival, are an area of much debate in demographic literature. It is suggested that education acts as a catalyst which allows a whole range of economic factors to become effective, providing the mother with functional autonomy and the ability to utilise health services outside the home (Kathevine and Walker 1991). Education is hypothesised to precipitate attitudinal change, increasing the awareness of the need for personal and household hygiene, and improving a mother's child care techniques, both of which have obvious connotations for the survival prospects of children (Badari 1983). Educated mothers are suggested to be less traditional, superstitious and fatalistic in their attitudes towards disease control, a product of the exposure that education has given them to the benefits of modern health care services. In addition, it is suggested that maternal education produces a more rational and greater use of preventative and curative medical services, due to the increased awareness and independence that education may provide (Grossman 1972). Alternatively, it is argued that the awareness of services does not differ greatly within populations, and that it is through an increase in resources rather than an increase in awareness that education influences child mortality (Linenbaum, Chakraborty and Elias 1985).

Maternal education may also act to influence both the timing and spacing of births (Caldwell and McDonald 1982). Progressing to a higher level of education reduces the prospect of early marriage and thus an early age at child bearing, avoiding the detrimental effects that young maternal age may have on child survival. The prevalence of hypergamy in India (the marriage of a female to a male of higher education) may also act to increase the mean age at marriage among those of higher education (Sheela and Audinarayana 1998), again delaying the onset of reproduction. Maternal education may also act to increase the awareness of the negative consequences of short birth intervals, and encourage the spacing of births through the adoption of modern contraception (Tulasidhar 1993).

The influence of the working status of the mother on the survival of her children has two possible outcomes. It is suggested that in an environment of poverty, where the mother has to return to work soon after delivery, the risk of infant mortality may be increased due to the early termination of breast feeding (Tulasidhar 1993). In addition, the absence of the mother from the household for employment may act to decrease the quality of care provided to children, again increasing their risk of injury and contamination from poor sanitary environments. Basu and Basu (1991) found a significant detrimental effect of mother's work outside the home on infant mortality in south India. Alternatively, female labour force participation may increase household income, in turn reducing the prospect of infant and child mortality through an increase in monies available for food and health resources. In a study of female labour in Kerala, Mencher (1988) found that mother's income was more likely to be utilised for health services than that of the other household members, thus female employment may act to reduce the prospect of infant mortality.

2.5.4 Environmental Factors

The living conditions into which a child is born and raised may have an influence on health status through the exposure to contamination and disease pathogens in the physical environment. Whilst bio-demographic factors are more influential on mortality in the neonatal period, environmental factors have been shown to be significantly related to survival status among post-neonates and children (Raml 1998). The effects of environmental factors are modified by individual behaviour which influences the extent to which the physical environment is allowed to affect the health of the child.

Environmental factors have the greatest impact on mortality where the living conditions are conducive to the spread of infectious diseases, and hence are more influential among poor communities which are characterised by informal housing. In India, housing conditions have been shown to be significantly related to the prospect of child survival, with those in kaccha housing experiencing a two fold increase in their risk of child mortality relative to those in pucca housing, when not controlling for other factors that may influence mortality (Sandhya 1991). The explanation for this lies in the informality of kaccha housing, which creates health hazards through poor ventilation, lack of modern facilities such as electricity, and informal sanitation. In a study of rural Gujarat, Gandotra, Das and Dey (1982) found that two-thirds of those living in rural areas had no electricity, creating an increased risk of respiratory infection through cooking with smoky fuels in poorly ventilated conditions. In addition, 97% of households in rural areas had no formal toilet facility and used open common grounds. This lack of formal sanitation facilities among poor communities, even those composed of pucca houses, acts to increase the risk of infectious diseases by increasing the number of disease pathogens in the environment.

Informal drainage systems may contaminate water supplies with water borne pathogens and faecal coliforms, hence increasing the risk of infectious and parasitic diseases. Prasad (1997) notes that rates of child mortality in rural India are three times higher for those who draw water from a kaccha well compared to those using a more formal bore well. In addition, the lowest rates of mortality were found among those with formal water supplies within their household, and the highest rates among those taking water from a river. These differentials in child mortality by water source reflect the importance of infectious and parasitic diseases as causes of child death. However, the relationship between water supply and mortality may not necessarily be a direct relationship. Water supply may act as an indicator for the general socio-economic status of the household, and mortality differentials may be the product of differences in the standard of living between households, rather than a direct cause of the type of water supply used by the household.

The social environment in which a child is raised may also have consequences for survival (Pebley, Goldman and Rodriguez 1996). Simmons et al. (1982) note that a supportive community environment is an important determinant of child survival, providing a social network of support for mothers and increasing the dissemination of knowledge on health care. Sastry (1996) suggests that there are two ways in which community characteristics can influence child survival. Firstly, the social and economic characteristics of a community may act to influence mortality between communities. Mukhopadhyay (1989), in a study of West Bengal, showed that the level of economic development was instrumental in determining mortality differentials between the villages of Sanhipur and Aminpur, with the developed village Aminpur having much lower rates of child mortality. It is suggested that the level of economic development in a community is indicative of the health services available and educational level of the population, factors which are influential in child survival.

The second mechanism through which community characteristics may influence child survival is by exacerbating or mitigating mortality differentials based on socio-economic attributes. It is suggested that community level factors may complement or act as a substitute for certain household attributes that may be affecting child survival (Sastry 1996). In a study of West African countries, Benefo and Schultz (1994) showed that the influence of maternal education on infant mortality was complemented by urban residence and the proximity to a health facility. Alternatively, a study of community level effects in Brazil demonstrated that health services functioned as a substitute for the effects of maternal education (Thomas, Strauss and Herques 1991). Thus, it would appear that the effects of community level factors are culturally specific, and that there is no general relationship to be noted between community and child mortality. There exists a dearth of literature surrounding community level influences on mortality in India. However, given the noted disparities in the distribution of health facilities, and the differences in social and economic development between rural and urban areas, it seems plausible to suggest that such community level factors will have some influence on the levels of child survival in that community.

2.5.5 Cultural Factors

"Culture is that complex whole which includes the knowledge, belief, morals, law, customs, and other habits acquired by man as a member of society" (Taylor 1971:75)

There are numerous religious, regional, linguistic and caste variations in child care within India that may result in mortality differentials (Basu 1990). Chandrasekhar (1972) suggests that such differentials are the product of the differing knowledge about child care, which in turn is a result of a collection of customs, rituals, traditions and taboos that exist in various ethnic groups. The effects of religion and culture on child survival are inseparable, as religion is the creator of many cultural practices prevailing in India. Bajkhaif and Mahadeven (1993) demonstrate the potential influence of religion on child survival through a comparison of the Sunni and Dudekula populations of Andhra Pradesh. The Sunni are an orthodox Muslim population with a relatively high level of economic development. The Dudekula are also Muslims, but are converts from the backward caste of Hindus, and thus draw traditional elements from both Islam and Hinduism. As a result the Dudekula are less orthodox than the Sunni, particularly in the status held by their women. A study of infant mortality among the two populations found that mortality was significantly higher in the Sunni population despite their higher levels of economic development. This was attributed to traditional child care practices which arise from religious beliefs. The Sunni believe in the efficacy of the talismanic thread, a thread given by magico-religious healers in the community and worn around the neck of the child to warn of the evil spirits that bring disease. It was found that 83% of those practising the talismanic method had experienced at least one child death. In addition, the relatively lower status of women in the Sunni population was suggested to have an influence on their decision to use and have access to health services. The Dudekula population, however, was more receptive to modern medical methods, perhaps explaining their lower levels of infant mortality. This example demonstrates the importance of religion in creating a set of child care practices that may have consequences for child survival.

Basu and Basu (1991) note that traditional beliefs about disease are often strong enough to overcome the demonstrated effects of modern medicine. Curative treatments are often accepted as they have a visible effect in removing symptoms. However, preventative treatments, such as child vaccinations, often produce mild symptoms, and are thus perceived as being harmful to the child. It is suggested that this may account for the high drop off rates for the triple antigen vaccination found in much of north India. Beliefs about the origin of disease may also affect the decision to use health services. In India, measles and chickenpox were traditionally thought of as a condition of been visited by a goddess (Mariamma in north India, and Sitala in the south), and thus no health advice was sought for these diseases. The presence of such beliefs may act as a barrier to the effectiveness of modern health programmes, thus acting to maintain high levels of infant mortality. However, it may be suggested that the recent success of immunization programmes in India reflects the relative scarcity of these beliefs, which may be confined to small sectors of the population.

Child mortality differentials are also apparent between the differing caste groups. Those in the scheduled castes and scheduled tribes have approximately twice the level of child mortality found among the forward castes (Prasad 1997). The lowest risk of child mortality is found among upper caste Hindus (Mukhopdhyay 1989). These mortality differentials can be explained through the wide socio-economic disparities that exist between castes. Prasad (1997) reports that a majority of those in the scheduled caste and scheduled tribes are uneducated landless labourers in rural areas, or are employed in the informal sector in urban areas. As a result, they have limited knowledge and resources with which to improve the health status of their children. In addition, the lower castes demonstrate a tendency to follow their caste occupation, and thus remain in the low income groups. Low household income has obvious implications for child survival through the limiting of household resources.

2.5.6 Maternal Health Care Utilisation

This section reviews the literature surrounding the utilisation of maternal health care in India, discussing the mechanisms through which the uptake of such services may affect the survival prospects of infants. Previous sections have discussed broad categories of mortality determinants. However, this section focuses specifically on health care use, as a major focus of this research is the potential role that the differential utilisation of maternal health care services between migrant and non-migrant populations may have in explaining mortality differentials between the migrant populations.

Majumdar (1988) reports that only 33% of all births in India are attended by trained medical professionals. The remaining births are conducted by untrained traditional birth attendants (dais) or relatives of the mother, usually the mother or mother-in-law, and take place at home. The occupation of dai is inherited, and they usually belong to the lower caste groups. No antenatal care is provided by the dai and they are called to attend at the onset of labour. The result of the dependence on untrained birth attendants is an increased risk of birth complications and subsequent neonatal mortality among those births conducted by untrained persons. In a study of rural Karnataka, Badari (1983) notes that the infant mortality rate was 20% higher among those births conducted by dais than among those births which took place in a government hospital. The high mortality associated with dai conducted births is suggested to be due to the lack of formal medical knowledge held by the dai. Chandrasekhar (1972) notes that dais lack the rudiments of midwifery and gynaecology, leaving them unable to cope with complications during child birth. In addition, some traditional child birth practices performed by dais increase the risk of post-partum infection. Prasad (1997) notes that in some rural areas a thick layer of sand and dung is spread on the ground where delivery is to be conducted, thus increasing the potential for infection. Also, the instruments used to cut the umbilical cord are often not sterilised, and may take the form of traditional implements.

Jesudan (1979) estimates that 95% of births in rural areas of India take place at home, compared to 70% of births in urban slums (Bhatnagar 1988). It is noted that the infant mortality rate for births occurring at home is 110 per thousand live births, considerably higher than the rate of 68 per thousand live births for those born in medical institutions

(Gunasekaram 1988). This mortality differential is due to a combination of the unsanitary birth environment at home, and the lack of formal medical expertise to aid in the event of birth complications. Tetanus mortality has been shown to be 50% higher among those born at home, attributed to the unhygienic and unscientific method of delivery (Meegama 1985).

Despite the demonstrated higher mortality of dai conducted home births, this form of child birth continues to dominate in India. Basu (1990) suggests that the continued reliance upon informal child birth practices is due to a combination of cost and tradition. Costs are incurred if child birth takes place in an institution, even the free government services have indirect costs through transport and the removal of the woman from household employment. Thus, the poorest sectors of the population are economically inclined to depend upon the relatively more affordable method of dai conducted home births. In addition, it is suggested that child birth in a formal institution removes the woman from her own territory and into an unfamiliar environment. In parts of India where the cultural status of women limits their exposure to formal health services, women are reluctant to attend a hospital due to their unfamiliarity and fear of institutions. The use of a dai ensures that birth is conducted by a person from the same social mileau, thus reducing any sense of alienation for the mother. In this environment dai conducted births become the accepted norm, and thus such traditions are hard to dissolve, despite the presence of modern health facilities.

The utilisation of prenatal and postnatal medical care can have consequences for the health status of both the mother and the child. Prenatal care aims to promote the normal growth of the foetus and the health status of the pregnant woman, whilst postnatal care helps to detect diseases of early childhood, monitor growth and physical/psychological development, and monitor the health of the mother. Rates of uptake of both prenatal and postnatal care are low in India, and have wide socio-economic disparities (Goyal 1989). The uptake of such services is more prevalent in upper class Hindus, educated groups, and those involved in non-agricultural production (Saksena and Srivastava 1986). It is suggested that such differential rates of utilisation are the product of the differing levels of knowledge of the potential benefits these services may have for child survival.

Karnatikar and Sinha (1989) report that apathy towards the use of modern medical services coupled with an ignorance of the needs and advantages of maternal health care results in the low rates of service utilisation in North India. Again, the prevailing beliefs of a community may act to limit the utilisation of modern services. Alleyne (1976) notes that health behaviour may be inhibited even when knowledge and attitudes are changed because of the constraints of conforming with the community, familial attitudes, and religious beliefs. In addition, cultural attitudes towards health are often generations old, and the women themselves may feel secure in following tradition rather than experimenting with modern medical methods.

The government health services provided in many slums and rural areas, although free, are often characterised by over-crowding, low staff levels, and a lack of basic resources to treat ailments (Kapil 1989). As a result, the poor sectors of the population who are forced to depend upon these are exposed to inferior health services, which it is suggested discourages their use and accounts for low service utilisation among the poor (Khandekar 1993; Prasad and Somayajula 1992). In a study of Uttar Pradesh, Karnatikar and Archarya (1994) found that private health facilities were used for conditions which the respondents considered as serious (complications in pregnancy and fever), whilst government services were used to treat common ailments. The payment for medical services in private facilities creates the perception of a superior standard of service, thus increasing their utilisation for serious conditions. The poor quality of government health services and the consequent dependence upon private facilities may act to create an environment among the poor in which the health needs of the mother and child are neglected.

The literature reviewed has examined the factors that act to influence the utilisation of maternal health care services, and has concentrated primarily on demand driven influences. However, the supply of maternal health care services must also act as a major influence on their utilisation, as services can only be used if they are available in an area. Karnatikar and Archarya (1994) note that a disparity exists in the availability of maternal health services between rural and urban areas of India, with low levels of service provision in rural areas. Hence, the low rates of service utilisation in rural areas are not only due to cultural factors inhibiting their use, but also the unavailability of services in some areas, which result in a reliance on traditional forms of health care.

2.4 Summary

This chapter has outlined the factors that the literature suggests are the major determinants of infant and child mortality in India. Although such mortality has shown considerable declines over the past three decades, levels still remain high in relation to the developed world. National level estimates of mortality hide wide spread socio-economic and geographical differentials in both infant and child mortality. It is apparent that the determinants of mortality differ with the age of the child, such that neonatal and early post-neonatal mortality are largely influenced by bio-demographic factors and those factors reflecting the utilisation of maternal health care during pregnancy. Factors related to the socio-economic and physical environment of the child influence mortality at later ages, and must be considered the major determinants of child mortality.

Empirical studies suggest that influences on infant and child mortality may be in operation at three levels. Firstly, the bio-demographic and socio-economic characteristics of the mother directly effect the health status of her children. Household level factors also play a direct role in mortality, yet also act to modify the extent to which certain individual level factors influence mortality. Finally, community level factors create the environment in which both individual and household factors must operate, and thus have an indirect impact on infant and child survival.

Given the evidence presented in this chapter, it would seem plausible to suggest that the analysis of the Indian National Family Health Survey (1992) data will show the determinants of mortality to be drawn from a range of both socio-economic and bio-demographic factors. It is expected that the determinants of mortality will be different in each of the age groups analysed. However, the relationship between migration and mortality cannot be accurately predicted due the lack of empirical studies on this relationship in India. Chapter 3 discusses the literature surrounding the relationship between migration and child mortality, suggesting possible mechanisms through which migration may be considered a determinant of mortality.

Chapter 3

Migration and Mortality- A Literature Review

3.1 Introduction

This chapter provides an overview of the literature surrounding the three central themes of this thesis: migration theory, migration in India and, most importantly, the relationship between migration and mortality. The principal aim of this chapter is to establish the nature of any relationships that previous studies have found between mortality and migration, and to outline the theories of migration that may be used as potential explanations for results produced in this research.

3.2 Migration Theory

Migration has traditionally been defined as any permanent or quasi permanent change of residence from one location to another (Lee 1966). Such movements have been attempted to be explained in socio-economic, behavioural and spatial contexts through the development of migration theory, providing contrasting ways in which planners of migration policy can conceptualise the problems arising from mass movements (du Toit 1990). In the contemporary developing world, population mobility, in the form of rural to urban migration, has been increasing rapidly since the 1960s, India has witnessed a threefold increase in population mobility levels from 10.8% in 1950 to 30.6% in 1981 (Mehta 1990). This "shaking loose of people" (Zelinksy 1971) in the developing world is the product of the complex of vectors (of varying magnitude and direction) including economic development, modernisation, culture, social and political change, and government policy (Patil 1993). During the past three decades migration in the developing world has not only increased in scale, but in the diversity of the groups involved, and the moves themselves are becoming increasingly complex in the nature of their spatial patterning (Hugo 1994). This section will examine the development of migration theory, providing a brief outline of the main concepts and frameworks that have been hypothesised to explain the process of internal migration.

3.2.1 Foundations of Migration Theory

In 1885 Ravenstein developed the "Laws of Migration" in an attempt to prove that migration did not occur without any definite law. The laws were initially based upon the results of the British Census of 1881, but in 1889 were expanded using data from a further 20 countries. Ravenstein himself suggested that this first attempt to provide laws for a seemingly sporadic human behaviour was ambitious (Lee 1966). However, these laws, as outlined below, continue to form the foundation of contemporary migration theory.

Ravenstein postulated that there were seven laws which could explain and predict the movements of a population. Firstly, migration proved to have a negative relationship with distance, with the number of migrants decreasing with distance from an urban centre, and a majority of migrants only moving short distances. It was suggested that such short term movements are dominated by female migrants, whilst migrations of a longer distance tend to be male dominated. The laws of migration placed much emphasis on the importance of the urban centre as an attraction for migrants. It was hypothesised that migrants do not move directly to their final destination, but in fact move in a number of stages, which Ravenstein labelled "step-migration". Consequently, a series of waves are created around urban centres as migrants move gradually between the rural and urban areas via intermediate settlements.

Rural natives are hypothesised to be more migratory than their urban counterparts. The reason for this lies in Ravenstein's laws that an increase in technology will attract migrants to urban areas, and that economic motives dominate a potential migrant's decision to migrate. Such economic motives consist of negative factors in the rural origin and the perceived positive factors associated with a move to urban areas.

Finally, Ravenstein hypothesised that for each main stream of migration a counter stream is produced. This law centred around Ravenstein's discovery that for every area of heavy net out-migration there was always some element of in-migration, which it was suggested was comprised mainly of return migrants.

In the development of these laws Ravenstein identified three main themes which continue to dominate migration theory: distance, urbanisation, and motive. Whilst contemporary theory continues to underline Ravenstein's relationship between migration and distance, and the importance of the urban centre, the development of migration theory has varied greatly on the motives attributed to migration behaviour. It is this aspect of migration that has lead to the creation of the following schools of migration theory.

3.2.2 Spatial Flow Models

A majority of migration models specify some aspect of movement in space, between origin and destination, either at the inter or intra national level. In the simplest form such models connect the origin and destination with a flow or reverse flow. However, this basic concept has been expanded to include theories on the effects of distance and flows of factors other than people (e.g information and money).

Stouffer (1940) developed the theory of "intervening opportunities" which states that the number of persons moving a given distance is directly proportional to the number of opportunities at the distance, and inversely proportional to the number of intervening opportunities. In 1960 this was expanded to include the concept of "competing migrants", in which the number of migrants to a destination was defined as a direct function of the opportunities between origin and destination, as well as a function of the number of migrants competing for opportunities at that destination.

Zipf (1964) produced the "gravitational model" in which the number of migrants between two communities is proportional to the product of their population divided by the shortest transportation distance between the origin and destination. These theories expand Ravenstein's original law of migration and distance to include the concepts of economic competition and the availability of transport. However, despite this they remain simplistic in their view of migration as a product of single economic forces.

In 1966 Lee established a "theory of migration" which attempted to construct an all encompassing theory that would explain human migration. Unlike the earlier spatial flow models this theory was based on the principle that migration was the product of a number of individual factors. Central to Lee's theory were the concepts of push and pull, that in every area there are countless factors which act to hold people within the area or attract people to it, and there are factors that act to repel people from the area. However, a simple calculus of positive and negative does not form the decision to migrate, the balance in favour of the move must be enough to overcome the natural inertia inherent in any population. In addition, it was hypothesised that between every two points there exists a set of intervening obstacles and opportunities, the effect of which will depend on the "impedimenta" associated with the potential migrant, which makes it more or less difficult to surmount, or indeed utilise, such opportunities. This "push and pull" theory recognised the individual nature of migration, stating that the calculus of the positive and negative is always inexact, and thus the decision to migrate must ultimately depend on the individual preferences of the potential migrant. This theory therefore recognises the complex phenomenon of migration and that the often necessary simplifying condition of early spatial flow models - that all other things are equal - is impossible to realise. Lee (1966) also hypothesised that migrants responding to positive factors at the destination tend to be positively selected, migrants responding to negative factors at the origin tend to be negatively selected, and where negative factors at origin are overwhelming there may be no selection.

Bouvier (1976) extended the "push-pull" theory and argued that the level of a society's evolutionary development must be incorporated into any general theory of migration. Push factors, it was suggested, are more likely to be present in less developed societies, and pull factors will precipitate migration in a more economically developed society. Thus, people are "pulled" into an urban area as urbanisation and industrialisation emerge alongside societal development.

Spatial flow models, therefore, are characterised by the principle that there are forces associated with both the origin and destination that act to produce migration flows in a population. The more complex models, such as that suggested by Lee (1966), recognise the complexities associated with the presence of intervening opportunities and the individual characteristics of the migrant. However, it may be argued that such spatial flow models misrepresent reality in their attempts to provide a single cause-effect relationship for migration. Bogue (1977) argues that it is incorrect to assume that potential migrants share homogenous information concerning the destination, and that the skills needed for migration are never equally distributed throughout the population. Furthermore, such models may be seen as inappropriate for a developing nation such as India where much of the migration is circulatory in form, and is concentrated on rural to rural movements (Mehta 1990).

3.2.3 Cost-Benefit Approach

The traditional push-pull approach explained migration by correlating the volume of migration and the direction of the migration flows with objective indices of external conditions. In contrast the cost-benefit analysis attempts a more subjective approach, explaining migration behaviour through the combination of external forces and the interpretation placed on these forces by each individual migrant. Such theories argue that subjectivity need not imply irrationality, and that the behaviour of individuals is the result of rational calculations of alternatives based on the potential migrant's perception of their total situation. The main hypothesis of cost-benefit models is that if the perceived influence of the pull factors that are commonly thought to influence migration are greater than the actual or potential costs of migration plus potential benefits of non-migration then migration will occur.

Sjaastad (1962) formulated the first of such cost-analysis based migration models, the "human investment theory of migration". In this theory the decision to migrate is treated as an investment making decision involving costs and returns distributed over time, returns including monetary and non-monetary components. Non-monetary components consist of "psychic benefits" that result from locational preferences, for example leaving familial surroundings and the adopting of new languages and culture. Monetary components include the perception of economic advantages of the destination, costs incurred in the migration and the disposal of property. The theory assumes that in deciding to move migrants tend to maximise their net real life-span incomes, and that they are able to approximate their life-span incomes in the present place of residence and in the destination. However, it seems plausible to suggest that given the high levels of unemployment in the urban areas of many developing countries, migrants are only fully aware of the economic situation at their origin. Thus, migration arises when the perceived economic position rather than the actual economic position of the urban area is greater than that of the rural origin.

Todaro (1976) suggested a model which attempts to incorporate the problem of high urban unemployment. In this model the decision to migrate includes the perception by the potential migrant of an "expected" stream of income that is a function of both the prevailing urban wage structure and a subjective probability of obtaining employment in the urban sector. Todaro (1976) suggests that rural-urban migration is a two stage process. In the first stage migrants arrive in urban areas and either remain unemployed or are employed in informal sectors whilst seeking formal sector employment. In the second stage migrants succeed in achieving formal sector employment, and thus earnings are sufficiently higher to offset those lost in the first stage, hence the migrant is still acting rationally in their decision to migrate.

Bogue (1977) argues that this cost-analysis approach is more appropriate in explaining migration behaviour than the traditional dichotomy of push and pull as it perceives the migrant as putting themselves in motion, rather than the dependence on external forces suggested in spatial flow models. Given the large disparities that exist between the economic environments of rural and urban areas in much of the developing world, it seems plausible to suggest that migration may indeed be a product of both the objective and subjective push pull factors described in the cost-analysis approach.

The theory of the cost-analysis approach was tested using a case study of migrants to Chicago between 1958-59 (Bogue 1977). It was discovered that economic and employment considerations weigh heavily on the decision to migrate. The primary strategy for reducing the costs of migration was to accept a lower standard of living when first arriving in the city, thus suggesting the validity of Todaro's (1976) two stage hypothesis. However, most migrants felt that this was only temporary, and that migration would be advantageous to their economic position. Although this study refers to a developed society, the themes it highlights on migration behaviour may be applied to most populations (Bogue 1977). It appears that the individual subjective forces, which had previously been held as epiphenomena to objective forces, are equally important in forming the decision to migrate. Subjective forces are present in all populations, yet the form they take is dependent on the individual socio-cultural environment.

3.2.4 Multi-causal Models

In response to the cost-analysis and push-pull theories a number of models have attempted to represent a multi-causal nexus of influences on migration, with the assumption that a process as complex as the relocation of people cannot be explained in wholly economic, personal or environmental terms. In these dynamic models the area of origin is in constant contact with the multi-cultural environment of the destination, thus ensuring an exchange of skills and information. It is hypothesised that such communication precipitates migration through the gradual dissolution of the traditional ideals inherent in the area of origin (Mabagunje 1970). Consequently, chain migration is commonplace as prospective migrants hear or learn of conditions in urban areas through contact with other migrants.

Mabagunje (1970) developed the "systems approach" to migration which conceptualised migration behaviour in terms of rural and urban subsystems, holding unique sets of factors which would either repel or attract migrants. However, unlike the uni-directional push and pull models, migration is assumed to be a circular and self-modifying system in which the effects of changes in one part can be traced through the whole system. Thus migration can be visualised as a continuous process, which it may be suggested is more appropriate for the current patterns of circulatory migration witnessed in much of the developing world.

The "migration potential index" (du Toit 1990) recognises that the motivations for migration are not equally weighted, there are primary and secondary factors in operation. Primary factors are those relating to the basic needs of a potential migrant (housing, employment), whilst secondary factors include more subjective factors (locational preference, climate). As in the cost-analysis approach this model assumes that migration motivations are non-uniform throughout the population. Each potential migrant has a background and personality which predisposes them to particular values and choices, which form the basis for an individual's decision to migrate.

Multi-causal models have thus taken the basic concept of the cost-analysis approach, one in which migration is the product of a calculus of net gains, and have established a system in which the factors influencing such a calculation are allowed to have differing levels of importance and are assumed to be interdependent. Thus, it would seem plausible to suggest that this form of model more accurately reflects the complexities involved in the decision to migrate, and the individual nature of such a decision.

3.2.5 Circulatory Models

The models described so far have assumed that migration is a uni-directional finite process. However, migration in the developing world since the 1960s has been characterised by circulatory migration, movements that involve moderately long durations of stay at a destination, but do not necessarily eliminate an eventual and equally permanent return to the place of origin (Chapman and Prothero 1985). It is argued that the process of circulatory migration is a response to two main factors in operation in the developing world (Chapman and Prothero 1985). The security associated with the natal environment through access to local resources, and the ensured sharing of common values and beliefs encourages the migrant not to sever their links with their place of origin. However, the need to migrate is a product of locationally widespread opportunities created by the disequilibrium in industrial/commercial development in the developing world.

Models of circulatory migration have tended to concentrate on labour migration, and the factors responsible for this process. It is argued that the pressures in operation in both the rural and urban areas result in an oscillation between rural and urban areas, which may continue for much of the productive life. Migrants continue to be associated with their place of origin, not only through their return, but also by the cross-flow of remittances and information (Ross and Werner 1977). However, there appears to be a lack of models that offer explanations for the individual's decision to participate in circulatory migration. Most of the available models offer macro-level explanations, detailing the effects of capitalist penetration into traditional societies and the consequent wage differentials that precipitate circulatory migration. One of the few available individual level approaches suggests that circulation reflects the attempts of rural households to maximise family welfare and avert financial risks (Chapman and Prothero 1985). It is argued that circulation is a response to the fact that permanent withdrawal from rural areas may lead to the relinquishing of land rights and household income, thus circulation acts as a form of insurance against this. Todaro (1976) suggested that circulation was a response to the likelihood of securing employment in an urban area, with migrants returning to their rural origins if unsuccessful in gaining urban employment.

It would appear, therefore, that attempts to explain the process of circulatory migration have been dominated by economic theory, concentrating largely at the macro-level. It may be suggested that the concepts available in the multi-causal and cost-analysis approaches can be applied to circulatory migration. The decision to migrate must arise from some calculus of net gains, and it seems plausible to suggest that this process of decision making is present in all types of migration.

3.3 Internal Migration In India

The Indian population has traditionally been considered immobile in terms of rural to urban migration in migration literature (Singh 1992; Mehta 1990; Skeldon 1986), with 60% of all movements occurring between rural areas at the intra-district level (Singh 1992). However, the past four decades have witnessed a gradual change in this pattern. Urbanisation has increased steadily since 1950, the most rapid period of growth being from 19.9% of the population living in urban areas in 1971 to 25.7% in 1991 (Diwaker and Qureshu 1992), with the level of inter-state migration and consequently the distances involved in migration displaying a considerable increase

(Gosal 1961). As a result over 200 million people now live in the cities of India (approximately 25% of the total population), 30% of which live below the poverty line (Selvaraj and Rao 1993). This section will provide an overview of the available literature on internal migration in India, focusing on the changing levels and patterns of migration, and outlining the main characteristics of internal migrants.

3.3.1 Volume Of Migration

" *India is, then, by and large, a land of native peoples. Men and women live among friends and relatives. Men are born, go to school, work, marry and die in the same community. Their wives come from nearby villages, mainly within the district, some from villages in nearby districts, fewer still from villages in neighbouring states.*" Weiner (1978:21)

This view of migration in India is echoed throughout the literature, India is constantly described as a nation with an immobile population. The volume of internal migration has been increasing steadily throughout the century, yet the percentage increase in migration (despite the involvement of large absolute numbers) has been viewed as small in comparison to the mobility transitions that have occurred in parts of sub-Saharan Africa (Skeldon 1977). Migration in India has traditionally been dominated by short-term rural to rural movements, which account for more than 60% of all migrations, and are comprised mainly of women moving between their natal and affinal homes upon marriage (Singh 1992). Long-distance urbanward migrations form only a minority of all movements within India, leading to the literature to describe India's population as "stubbornly immobile" (Mehta 1990) and remaining in the early stages of the mobility transition (Zelinksy 1971).

Literature suggests that the main factors behind the seemingly dormant nature of the Indian population are as follows. As the primacy of the agricultural sector in the Indian economy has resulted in "tying" the population to the land, it is suggested that long distance urbanward migration would only occur once the Indian economy develops a more industrial base. In addition to this, the dominance of agriculture has succeeded in creating a culture of settlement and cultivation, which it is suggested acts to discourage migration (Smita and Chandna 1991). The process of early marriage and the tradition of marriages between people from nearby villages and territorial endogamy (Libbee and Sopher 1975) has resulted in both early adult responsibilities and a reduction in the need to migrate long distances. Finally, it is suggested that such is the economic and cultural diversity of India, with some states larger in size than some European countries, that the sheer distances involved and the potential socio-economic adaptations required are in themselves sufficient to discourage long-distance migrations.

Despite this, the volume of migration in India has increased, albeit in small percentage terms, throughout the century. Davis (1951) made the first systematic study of population mobility in India using census statistics. It was reported that the vast majority of the population remained in their natal environment throughout their lives, the only major movements being females for marriage purposes. Zachariah (1964) confirmed this pattern of immobility in the early part of the century with the discovery that the total number of people moving declined from 7.4 million in 1910 to 4.1 million in 1930. However, it is important to remember that any studies referring to pre-Independence times are based upon censuses which it is known failed to cover the total population, and thus grossly underestimated the true extent of migration (Skeldon 1977). For this reason this section will focus upon the periods after 1951 when the census began to expand its interest in migration.

There has been a three-fold increase in mobility levels in India between 1931 and 1981, with the percentage of the total population classified as migrants rising from 10.8% to 30.6% (Mehta 1990). The increase in the number of migrants accelerated upon Independence in 1947, indicating enhanced spatial mobility in free India. By 1971 162.7 million Indians recorded a place of birth different to their present place of residence, and this figure had increased to 207.9 million by 1981 (Skeldon 1986). The increase between 1971 and 1981 was dominated by an increase in the number of those moving within India (155.4 million), whilst international migration played only a minor role (6.2 million). Singh (1992) notes that international migration is of little importance in the study of migration in India due its small role relative to the dominant intra and inter state flows. International migration has continued to account for less than 10% of total migration since the 1951 Census (except with the creation of Bangladesh in 1971, which precipitated the influx of 10 million refugees into India).

The massive rate of increase in the percentage of the population taking part in migration since 1930 has stabilised during the past three decades, such that now approximately 30% of the total population are involved in internal migration. Between 1971 and 1981 the increase in the percentage of the population migrating was only 1.2 %, however this refers to an increase of over 46 million people (Skeldon 1986). This continued increase in the numbers taking part in migration would appear to be parallelled by a change in the types of migration taking place. Skeldon (1986) suggests that an analysis of both the intercensal averages for migration, and the numbers migrating in the year prior to the census would highlight the types of migration occurring. It is apparent that 13 million Indians moved in 1960-61 compared to an intercensal (1961-1971) average of only 9 million. In the 1981 Census there were 10.4 million recorded migrations in 1980-81 and an intercensal average of 9.9 million. Thus, if we assume that a single year is more efficient at highlighting short-term moves, and that there was nothing unusual about 1961, then it would appear that the number of short-term moves has decreased between 1960 and 1981. Zelinksy (1971) argues that such a reduction is an integral part of the mobility transition occurring as a migration system evolves in a county. It would appear, therefore, that India is evolving it's migration system.

3.3.2 Rural and Urban Migration Flows

This section deals with the changing patterns of rural and urban migration, witnessed as the general participation in migration increased during the past four decades. During the 1960s migration was still dominated by local rural-rural migrations that had characterised Indian migration for most of the century. However, this period witnessed an increase in the number of short distance rural to urban migrations to local and regional urban centres (Skeldon 1986). Long distance migration, although still a minor aspect of India's migration system, was dominated by movements to urban areas, which tended to involve moves up the urban hierarchy. This decade also represented a period of substantial growth in urban economies and the associated stagnation of small towns (Bose 1980). Chapman's (1983) analysis of the growth of the 142 largest urban areas in India shows that it was the largest among these which, despite being more specialised in terms of urban functions, were growing the fastest. Thus, this period saw the beginning of the urbanisation process in India, although it started primarily in the form of long distance moves.

The increase in urbanisation has continued as the importance of rural to urban migration increases in the Indian migration system. During the 1960s the average outflow from rural to urban areas was 21% of all migration originating in rural areas, by 1970 this had increased to 25.4% and in 1990 over 40% of all rural migrants have an urban destination (Patil 1993). Subsequently the inflow of migrants with rural origins to urban areas has risen to 56.2% (Skeldon 1986). Crook and Dyson (1982) suggested that the growth in rural-urban migration in India would lead to such migration accounting for over half of the growth in urban areas. However, in the period 1971-81 rural-urban migration accounted for less than one-fifth of urban growth. This illustrates that although increasing, the role of rural-urban migration in India is not as large as some literature anticipated. Since the early 1970s the growth of urban areas has began to be spread more evenly among urban centres of all sizes (Mohan and Pant 1982), showing that rural-urban migration is no longer focused on specialised urban areas. This suggests that urbanisation has become a major aspect of the Indian migration system.

The consequences of this process have included the rapid growth of India's cities. The 1981 Census showed that all of India's one million-plus cities have over one-third of their population made up of migrants. During the period 1971-81 the rural growth rate was 19.7% compared to 46.4% in urban areas (Smita and Chandna 1991). However, literature continues to state that natural increase is more important than in-migration in the growth of urban areas (Vardyranathan 1969: Premi 1981).

Despite the increase in rural-urban migration in India since the 1960s, rural-rural migration continues to dominate the migration system. In 1981 71% of all migrants had rural destinations (65% rural-rural and 6% urban-rural), this figure is a slight decline on that of 75% witnessed in 1971 (Smita and Chandna 1991). A majority of those participating in rural-rural migration are female, due to the prevalence of patrilocal marriages. Although such a process has been in operation throughout the century, Weiner (1978) suggests that the Indian marriage market has become much wider, with longer distances apparent in the marriage system. A product of this has been an increase in the distances involved in rural-rural migration, with an increase in the number of inter-state rural-bound migrations. The green revolution in the north-west of India acted to precipitate an increase in the number of long distance rural-rural movements by increasing the opportunities for agricultural work (Sekhar 1993).

The remaining combinations of rural and urban migrations (urban-rural and urban-urban) continue to form only minor aspects of the migration system in India. Urban-urban migration has continued to account for approximately 5% of the total migration since the increase in urbanisation during the 1960s (Singh 1992). A majority of urban-urban migration is in the form of an upward movement through the urban hierarchy (as suggested in Ravenstein's Laws of Migration 1885). Greenward (1971) argues that such migration is dominated by public servants and those employed in the service sectors who wish to improve employment by moving to larger urban areas with potentially higher wages. Thus, most movements occur from urban areas with low per capita incomes to those with higher incomes per capita. Skeldon (1986) hypothesises that urban-urban migration is a form of "J-turn" migration in which previous rural-urban migrants return to urban areas near to their rural origins. However, there exists no empirical evidence to substantiate this claim.

Urban to rural migration has consistently constituted the lowest percentage of total migration, and consequently little literature exists to explain this trend. In general it is thought that an increase in rural to urban migration precipitates a parallel move of people out from urban areas and into urban suburbs (Bose 1980). However, there exists no direct evidence to suggest that this theory of migratory behaviour is applicable to the Indian situation. Bose (1980) and Rao (1966) both suggest that the lack of employment in urban areas is the major factor behind urban-rural migration, suggesting that it is a form of "return" migration. In addition it is argued that the return of temporary workers may form a substantial section of this migration stream. It is also reported that return migrants may be those who have finished their economically productive lives in the urban areas, and are returning to their rural origins. Banerjee (1972) notes that those who own agricultural land are the most likely to take part in this form of migration. However, urban-rural migration in India would appear to be an area of study much neglected, and thus there are few solid empirical studies on which to base explanations for its existence.

3.3.3 Inter-State Migration and Spatial Distribution

In 1991 the population of India was recorded at approximately 950 million (Indian National Family Health Survey 1992). India is divided into 25 administrative states, varying widely in both size and their level of economic development. The population is unevenly distributed across these states, concentrated heavily in states with major urban areas. This section details the levels of inter-state migration that have developed over the past four decades in India, and describes the main areas of in and out migration. In comparison with intra-state migration, the level of inter-state migration in India is very low. During 1981 8.4% of the total population had moved across a state boundary, comprising less than 10% of the total migrants (Smita and Chandna 1991). However, it is important to remember that this percentage still refers to an absolute number of 56 million people per year taking part in inter-state migrations.

Unlike the changing trends in the flows of intra-state migration, the pattern of the spatial flow of inter-state migration in India has remained almost stagnant during the past four decades. Since the 1950s the general trend has been for the smaller states, with high proportions of Christian populations, and high rates of literacy to be the main attraction for inter-state migrants. In contrast, the larger states (Uttar Pradesh and Rajasthan) have consistently been areas of massive out-migration. In addition, the Union Territories, which are smaller and highly urbanised compared to the states, have all displayed high levels of in-migration (Smita and Chandna 1991). As a result, the general trend of inter-state migration in India over the past four decades has been a radiation out from the north-central states towards West Bengal in the east, Delhi and Haryana in the west, and Madhya Pradesh and Maharastra towards the south and south-west (Singh 1992). The principal characteristic of this inter-state migration has been the consistency in its spatial patterns, which has continued since the beginning of the century. Mehta (1990) suggests that India's pattern of economic development is the main factor behind this continued trend. Throughout the colonial period development was concentrated along the "penetration lines" beginning in the major sea ports. In addition, capitalist plantation agriculture and mining activities were established in the east. Once established these economic centres became the destination for migration streams, focusing on the centres of Bombay, Madras, Calcutta and Delhi. The post-Independence era saw a continuation of these streams as economic development continued to be concentrated in established areas of development.

The period after 1971 saw a large increase in the volume of inter-state migration, although the spatial patterns remained constant. Prior to this period, inter-state migration had accounted for less than 5% of all migration, this increased to almost 10% after 1971 (Mehta 1990). Since then the level of inter-state migration has remained approximately stable. The main areas of out-migration have been Uttar Pradesh (1.01 million out-migrants 1971-81), Bihar (1.72 million), Tamil Nadu (1.36 million) and Punjab (1.35 million). The states of Kerala, Rajasthan, Gujarat, Orissa and Andhra Pradesh have also witnessed out-migration although the numbers involved have been smaller. Areas of in-migration are far more wide-spread than those of out-migration and share the common characteristic of low population density (less than 150 per square kilometre). The main areas of in-migration have been West Bengal (5.58 million), Madhya Pradesh (2.36 million), Maharashta (4.67 million), and Delhi (2.82 million).

It is possible to establish a series of factors that are common to all areas of in-migration and out-migration. Smita and Chandna (1991) note that areas of in-migration can be characterised by their large demand for agricultural labour, an increasing degree of the commercialisation of agriculture, and the presence of land reclamation activities increasing agricultural land. In addition, such areas tend to have mining industries and industrialised urban centres, and hence greater employment prospects. The north-west area of Punjab, Haryana and Rajasthan are prominent areas of in-migration for migrants from rural areas. Smita and Chandna (1991) suggest that the green revolution that has been occurring in these regions has accelerated the agro-based industrial development, and the ensuing commercialisation of agriculture has lead to the creation of greater employment in the rural sector, thus attracting rural migrants. Gosal and Krishan (1975) report that migrants have been directed towards urban industrial concentrations, plantations, and multi-purpose development projects. This can be seen with the influx of migrants in Gujarat after the expansion of the petro-chemical industries, and the continued pull of Madhya Pradesh and Maharashta which continue to be among the leading industrial centres of India. The creation of tea plantations in Assam lead to an influx of migrants from Orissa and West Bengal due to the creation of employment in a poor rural environment (Singh 1992).

Areas of out-migration are characterised by low levels of economic development, literacy, and agricultural productivity (Smita and Chandna 1991). Such areas also tend to have a high population density, the resultant pressure on agricultural land precipitating out-migration (Gosal and Krishan 1975). Thus, inter-state migration from these areas tends to be a response to rural poverty, with migrants moving to either urban centres or rural areas in nearby states in the hope of finding employment. For example, Uttar Pradesh is one of the main areas of out-migration, migrants from this area tend to be landless agricultural workers, who seek employment either by moving to the urban centre of Delhi or the agriculturally prosperous area of Punjab. Mehta (1990) argues that the sheer size of Indian states discourages the process of inter-state migration, and that only those states in close proximity to those with major urban centres will experience major out-migration. Subsequently, the states surrounding Delhi, Bombay, and Calcutta have experienced high levels of out-migration. However, not all urbanward inter-state migration has its origins in rural areas. Diwakar and Qureshi (1992) report that there exists a stream of urban to urban inter-state migration, with migrants moving from the economically developed urban areas of Punjab to Delhi. It is argued that the level of development in the origin stimulates the desire to move to an area perceived as being more economically developed, thus improving the migrants economic position. However, this example is isolated in the literature, and no others have been found to substantiate this claim.

Since 1951 the majority of inter-state migrations have concentrated on urban destinations, although the agricultural developments in the north-west have increased the number of rural to rural long distance migrants. This urbanward flow of inter-state migration has become concentrated on the mega-cities, Delhi now accounts for 26% of the urban population in the northern zone, Bombay 25% of the western zone, and Calcutta 31% of the eastern zone (Mehta 1990). As a result of this concentration, the urban-rural distribution of India's population is non-uniform across the country. The proportion of the urban to the total population in India in 1991 was 25.7%, with a low of 8.7% (Himachal Pradesh) and a high of 39% (Maharashtra) (Patil 1993). Nine States have levels of urbanisation above this national average: Andhra Pradesh (26.8%), Gujarat (34.4%), Karnataka (30.9%), Kerala (26.4%), Maharashtra (39.0%), Manipur (27.6%), Punjab (29.7%), Tamil Nadu (34.2%), and West Bengal (27.4%). It is apparent that most of these states are those with the highest levels of in-migration, emphasising the trend towards urban oriented migration at the inter-state level. However, the average speed of urban growth has declined from 22% in 1971-81 to 13.8% in 1981-91 (Patil 1993). Again, such growth is not uniform across the country. Only Kerala and Tripura registered an increase in their urban growth during 1981-91, with all states having a level of urbanisation above the national average experiencing a maintaining of their rate of growth. The four large northern states of Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh experienced rapid declines in their rates of urban growth throughout 1981-91.

It would appear, therefore, that the spatial pattern of inter-state migration in India is a product of the economic factors present in each state. Migration at this level appears to be a response to negative economic conditions at the origin, and perceived economic gain at the destination. The fact that such spatial patterns have remained intact for so long highlights the continued economic diversity of India. The growth of the urban areas suggests that the process of urbanisation will continue, however at present less than a quarter of the population lives in urban areas. The four northern states that are experiencing declines in their urban population account for 40% of India's population (Patil 1993). It is important to remember that despite the presence of these long established migration streams and the apparent urbanward nature of migration, India's population remains predominantly immobile and most migration occurs at the local rural-rural level.

3.3.4 Characteristics of Migrants

The study of the characteristics of mobile populations is an area much neglected in Indian demography, despite the availability of census data on migrants by age, sex and marital status. A majority of the literature on this subject refers to small scale empirical studies, from which the general characteristics of all migrants in India are hypothesised. The principal characteristic of Indian migration is its age selectivity, it has been shown that the age group 20-35 are by far the most migratory group (George 1965; Oberai and Singh 1981). However, female migrants tend to be younger than their male counterparts due to the practice of patrilocal marriage migration (Singh 1987). This selectivity is apparent in all migration streams at both the intra and inter-state level. This is the only characteristic that is universal to all migration streams in India. The following section highlights the main characteristics of migrants within the differing migration streams.

Each of the migration streams in operation in India is strongly sex selective. At the intra-state level females dominate the rural to rural stream, accounting for more than two-thirds of all it's migrants (Gill 1981). This domination is attributable to the process of marriage migration by females between rural areas (Libee and Sopher 1975). The rural-urban and urban-urban streams are both predominantly male oriented, and at the inter-state level all migration streams are male dominated (Skeldon 1986). Gill (1981) notes that the ratio of migrating females to the total migrants varies inversely with the distance of migration, emphasising the male domination of the long-distance rural-urban and urban-urban movements. The main reason behind such sex selectivity lies in the causes of migration: it is hypothesised that males migrate predominantly for economic reasons, whilst females migrate for marriage (Smita and Chandna 1992). Therefore, those streams with urban destinations, and hence perceived greater economic gains, will attract more male than female migrants. Rowe (1973) argues that when males migrate to urban areas, females remain behind to provide a sense of familial security in the rural areas.

Gulati (1983) studied the effects of male selective migration from Kerala and discovered that at the household level the major impact was an improvement in income due to the flow of remittances. However, this male domination of rural to urban migration is not uniform throughout India. Singh (1987) notes that such migration is more selective of males in the north of India, and that in the south there is a trend towards increasing female participation in rural-urban migration. The greater male selectiveness of migration in the north has been attributed to both the caste system and the religion. The prevalence of scheduled castes in the south has lead to female participation in migration, as such castes are usually landless, and thus the need for spousal separation to ensure land security in the rural areas is reduced (Bulsara 1964). The stronger influence of Islam in the north has restrained female migration, resulting in masculine sex ratios in many northern cities (Singh 1978).

However, the participation of females in all migration streams has been increasing during the last two decades (Skeldon 1986). This trend is particularly apparent in the rural-urban stream, where the sex ratio of migrants has declined from 119 between 1961-71 to 100 males per 100 females in 1971-81 (Skeldon 1986). This increase has been attributed to similar increases in rates of female participation in education and the labour force. De Souza and Singh (1976) report that females in the untouchable castes in the south of India have shown major increases in their rates of labour force participation, and that this has precipitated the migration of women for economic reasons. Ferre and Gulger (1983) note that the increasing number of female urban migrants has lead to an increase in the number of females employed in unskilled work in urban areas of south India. Between 1971 and 1981 the literacy rates of females in both urban and rural areas increased: rising from 15.8% in rural areas in 1971 to

20.9% in 1981 (Skeldon 1986). It may be suggested that this increase in female educational participation has increased female labour force participation, thus creating economic incentives for females to migrate.

Migration theory suggests that rural to urban migration is economically selective, with many migrants originating from the low income groups, and as a result remaining in the low income strata once in the urban areas (Bogue 1977). However, it would appear from the literature that such a process does not adequately explain the economic selectivity of rural-urban migration in India. Connell et al (1976) suggest that migration in India is not dominated by those in the lower socio-economic strata. It is suggested that for the poor, urbanward migration is a survival strategy against decreasing productivity in rural areas, whereas for the rich, such migration is a strategy of economic accumulation (Sekhar 1993). Rao (1986) suggests that the economic position of a migrant may not only provide the stimulus for migration, but will also provide the means of migration. Thus, the very poorest do not have the means to make the move, hence the poor landless remain insitu in the rural areas, while becoming further pauperised through the introduction of labourers from other rural areas (Breman 1985). It has been shown that the propensity to migrate to an urban area is highest among educated people in rural areas (Greenwood 1971). As a result the depletion of rural areas in India is occurring with the out-migration of the capital holding educated sectors (Oberai and Singh 1981). The availability of western style employment in the major urban areas, particularly the mega-cities, provides the main attraction for such migrants (Padki 1964). The rural areas may hold greater economic security for the unskilled and uneducated for whom employment is scarce in the cities (Epstein 1973). Also, it has been reported that the upper castes are more migratory than the lower castes (Eames and Schwab 1974), suggesting that castes which are no longer functionally integrated into the village economy are more mobile than others.

3.3.5 Summary

In summary, migration in India has a history of short distance female dominated rural to rural movements. The past four decades have witnessed slight increases in the numbers involved in migration, with the gradual emergence of migration streams with urban destinations involving longer distance movements. Recent changes in the economic activities of females is acting to slowly change the sex selectivity of some migration streams. However, it is important to remember that all the changes detailed in this review have been minor, the level of migration in India is only 30%, and only 25% of the population are urbanised. The average growth rate of migration in the past two decades has been approximately 5% (Smita and Chandna 1991). The main reason for much of India's migration has traditionally been marriage. The growth of urban areas and the resultant creation of industrial based employment has created economic incentives for migration, based predominantly on urban areas. However, the past decade has witnessed a decline in India's economic growth rate, from 3.4% per annum in 1965-70, to 1.4 % per annum in 1975-80 (Balasubramanyam 1984). Given this, and the tradition of immobility in the Indian population, it may be suggested that the current stable rate of urbanisation in India may in the future decades experience a decline.

3.4 Migration and Mortality

" It is changes that are chiefly responsible for disease, especially the violent alterations" (Hippocrates as quoted by Mascie-Taylor and Lasker 1988 page109)

" Most migrants adapt more or less successfully and without trauma to city life, but we have as yet no satisfactory theoretical model that can explain this adaptation and its variations" (Butterworth and Chance 1981 page 31)

For many years it has been noted that urban life is associated with an increased risk of disease (Benyoussef et al 1974). Epidemiological studies demonstrate that urban migrants have an increased susceptibility to both infectious and degenerative diseases (Smith and Zaidi 1994). However, demography suffers from a dearth of literature explaining the relationship between mortality and migration, although the relationship between migration and fertility is an area much studied (Sharma 1991; Singh et al 1981). Historical demography concentrates on the relationship between international migration and mortality (Curtin 1980), and recent literature arises mainly from a medical and biological anthropological background. Thus, demography holds few theories to explain the relationship between migration and mortality in the contemporary world. However, there have been recent attempts to utilise the concepts inherent in both the historical and biological approaches in order to create a framework for explaining the mortality-migration relationship emerging in the developing world (Brockerhoff 1995;1990). This section provides a summary of the early studies into the mortality-migration relationship, and reviews the demographic theories arising from these studies.

Literature from a biological-anthropological stance suggests that there are a number of reasons that would lead us to suspect, a priori, that urban living should be deleterious to human biology (Mascie-Taylor and Lasker 1988). It is suggested that humans were originally nomadic hunters living in small band populations, which differ greatly from the sedentary dense populations of contemporary cities. Harrison and Jefferies (1977) argue that even though humans are capable of a great range of adaptive responses to new environmental stress, the genetic limits are determined by the nature of adaptation to past environments. Thus, given the relative newness of cities in the evolutionary time scale, it seems plausible to suggest that the urban lifestyle poses a potential biological threat. Ninety-nine percent of our evolutionary history has involved humans living in social organisations based around kinship ties (Mascie-Taylor and Lasker 1988). In many rural areas of the developing world, such kinship structures are still in operation. Carlstram and Levi (1971) note that such social organisations differ greatly to the densely populated urban conglomerations of modern cities, and the move between the two types of social organisation may precipitate psychological stress and physical illness. In addition, literature notes that humans develop phenotypic adaptations to their local environments (immunity to disease etc.), and thus migration to a new environment may lead to physiological stress (Weissman et al 1978). Therefore, from the biological anthropological view we would expect urban bound migration to have severe impacts upon the health of the migrant. The following section outlines the studies that have attempted to establish the nature of this relationship.

Historical demography concentrates on the relationship between international migration and disease in the Nineteenth Century. Curtin (1980) demonstrates that the mass movements of European soldiers to the British West Indies, Dutch East Indies and India during the late 1800s lead to a rapid increase in mortality rates among the migrants. These "relocation costs" were due to the prevalence of tropical diseases in the destinations, to which the soldiers proved susceptible. Similar results were found with the analysis of the mortality rates of Indian migrants to Fiji between 1879 and 1919, who maintained the high mortality rates of their origin even when moving to a relatively low mortality destination. Although not directly comparable to the contemporary world, these examples demonstrate an important factor of the mortality and migration relationship. Migrants are susceptible not only to the causes of mortality at their destination, but also continue to be influenced by the mortality regimes of their origin. Hence, migrants have higher mortality than sedentary populations (Baker 1984).

Epidemiological studies based on urban migrants in the contemporary world have demonstrated similar results. However, the principal characteristic of all these studies is that since 1950 urban migrants have shown lower mortality rates at all ages than rural non-migrants (Baker 1977). In addition, it has been shown that urban migrants have higher rates of mortality than urban natives (Baker 1984), whilst still achieving lower rates of mortality than the rural non-migrants (Hollensteiner and Tacon 1982). The latter is attributed to rural poverty, malnutrition, differences in access to health services, and high rates of infectious diseases that it is suggested interact synergistically in developing countries to create high mortality rural environments (Mascie-Taylor and Lasker 1988). Thus it would appear that the migration-mortality relationship in the developing world has three associated levels of mortality: the high mortality in the origin, the low mortality of the destination, and the mortality of the migrants that stabilises between these two groups. The transition from rural to urban areas is hypothesised to lead to an increase in the prevalence of degenerative diseases in the migrating group and a decrease in infectious diseases (Koate 1978; Hiernaux and Maquet 1974). It is suggested that this is a result of the biological adaptation to urbanisation and a western lifestyle (Corruccini and Kaul 1983).

Medical literature traditionally believed that health differences observed between migrant and non-migrant populations were the result of heterosis or natural selection, and that human types were genetically fixed and would not change when exposed to new environments (Livi 1896; Ammon 1899). However, such beliefs were changed by the results of epidemiological studies showing that the children of immigrants differed significantly in their physical growth to their parents (Boas 1912; Sharpiro 1939; Goldstein 1943). It was discovered that the children of immigrants were taller and differently shaped to their parents, and that the difference was directly related to the length of time exposed to the new environment. Such results were attributed to the new socio-economic environment, with increased access to health services and improved nutrition among the primary factors. The theory of natural selection of migrants was dismissed by studies demonstrating that differences in socio-economic status confound any unique biological difference between migrants and non-migrant groups (Kobyliansky and Arensburg 1974). However, these early results were based on international migration to developed countries. Recent studies on the developing world have shown that movement to urban areas is not always associated with increased health status of children.

Villarejos et al. (1971) show that the children of migrants to the urban areas of Costa Rica display mortality rates similar to that of their rural counterparts, whilst Manila et al (1981) demonstrated that migration to urban areas of Mexico resulted in an increase in child mortality rates. It is suggested that this is a result of the migration to urban squatter settlements, which are often placed on the outskirts of the city, and hence have similar poor environmental and health infrastructures to the migrant's rural origins (Morley et al 1968). Indeed, it has been shown that higher socio-economic status migrants, who obviously avoid the informal housing sectors, experience a decline in their mortality rates (Bogin and MacVean 1981). Thus it would appear that urban migration does precipitate a decrease in mortality, but only if there is a significant improvement in the physical environment.

Brockerhoff (1995;1994;1990) has used the data from various Demographic and Health Surveys to analyse the relationship between mortality and rural to urban migration in sub-Saharan Africa. The results confirm those of earlier epidemiological studies that suggested migrants had higher mortality than urban natives, and lower mortality than rural non-migrants. However, Brockerhoff (1994) suggests that there are three groups of children that can be affected to differing degrees by the process of rural to urban migration: those children left behind in the rural areas: those who accompany their mothers on migration: and those born after migration has taken place. It is postulated that each of these groups has a different survival prospect, with those remaining in the rural areas and those born either two years before or after migration having the greatest mortality risks (Brockerhoff 1995). Children born more than two years after migration have the lowest rates of mortality, and there appears to be no decline in mortality rates beyond this with duration of residence in urban areas (Brockerhoff 1990). However, even those children born more than two years after migration still do not manage to achieve the low mortality rates of the urban natives (Brockerhoff 1995).

Therefore, the available literature agrees that there is a relationship between mortality and migration. This relationship appears to take the form of a transition to mortality levels that are in between those of the origin and destination. Urban bound migration would thus appear to have a positive impact on child survival prospects. The following section discusses the potential explanations for this migration based mortality transition.

Brockerhoff's (1994) analysis of the Demographic and Health surveys of seventeen countries from Asia, Latin America and Africa demonstrated that those children who remained in the rural areas had the highest rates of mortality. Brockerhoff notes that this group is composed of the children of non-migrants and children left behind with foster families by migrating parents. The high mortality rates of this group is attributed to two sets of factors. Firstly, it is argued that the rural environment is predisposed to high mortality, given the inferior health infrastructure, the instability of agricultural employment, and the prevalence of malnutrition. It is suggested that the effects of these factors on the survival prospects of children will be heightened in the case of foster children. Brockerhoff (1994) demonstrates that foster children in rural areas of sub-Saharan Africa have inferior access to health resources and food than the natural children of their foster family, hence decreasing their survival prospects. However, the main reason for the difference in mortality rates between migrants and rural non-migrants appears to be the effects of migrant selectivity. Brockerhoff and Eu (1993) demonstrate that rural to urban migration is selective of the younger, higher educated members of the rural population. There is a wealth of literature to suggest that these factors are also positively associated with low infant and child mortality (Menken 1989; Madise and Diamond 1995). Thus, it would appear that rural to urban migration is selective of those with characteristics of low infant and child mortality, hence their superior mortality rates relative to the rural non-migrants are established prior to migration to urban areas. It has been demonstrated that there is no association between the presence of child mortality in a family, and the family's propensity to migrate to urban areas (Brockerhoff 1994). This suggests that urban migration is not a response to the high mortality environments of the rural areas, and is influenced by those factors acting to select migrants from the higher socio-economic strata.

It is argued that the physical process of migration may lead to the encountering of a new set of determinants of infant and child mortality that are not experienced in the rural areas (Brockerhoff 1994; 1990). Migration may involve exposure to new disease pathogens which, together with the possible physical hardship of the move and the temporary unavailability of health services, will act to increase the health vulnerability of the infant (Brockerhoff 1994). The impact of these factors is related to the magnitude of the migration, long distance migrations will potentially involve greater physical hardship, and thus be associated with the highest mortality rates. Hence, step-migration will have the lowest impact on infant and child mortality due to the constant resettlement of the migrant. Given that migration in India is dominated by short distance intra-state moves, it may be suggested that the effects of the physical migration process on infant and child mortality would be minimal.

The literature surrounding the mortality-migration relationship concentrates heavily on the process of migrant adaptation to the urban environment, and the factors that prevent migrants achieving the mortality rates of the host society. Early epidemiological studies suggested that the general trend in mortality after migration is that of a U-shaped curve (Gullahorn and Gullahorn 1963). It was suggested that immediately after migration there would be a period during which the migrant has a high risk of both infectious and non-infectious diseases, the risk of such diseases declining with duration of residence in the urban environment. As urban adaptation takes place, degenerative diseases become the major cause of mortality among the migrant population, thus forming the final increase in the U-shaped curve. However, studies of the impact of migration on child mortality in the developing world have shown that the high mortality of the migrant population does not decline with duration of residence in the urban area, and constantly remains above that of the host population (Brockerhoff 1995). Migration adaptation refers to the extent to which the migrant population assimilate economically, socially and culturally with the host society (Goldscheider 1989). It is argued that it is the extent to which such adaptation occurs that results in the survival prospects of the children of migrants (Brockerhoff 1990). The continued presence of higher mortality rates in the migrant population than in the host society would indicate that such adaptation is not occurring successfully in urban areas of the developing world.

Rural to urban migrants in the developing world traditionally occupy the most economically inferior sectors of the city (Benyoussef et al 1974). In India 30% of all urban residents live below the poverty line (Mehta 1990). The housing of urban migrants is characterised by informal dwellings on the outskirts of the urban area, lacking in formal health and sanitation facilities (Brockerhoff 1995). The environmental characteristics of such informal housing have been shown to be detrimental to the survival prospects of migrant children. A study of the environmental conditions in a slum area of Andhra Pradesh illustrated that child mortality was positively related to the lack of a clean potable water supply, and to the informality of the household building materials (Dhanalakshmi 1993). The influence of environmental conditions on child mortality has been emphasised in studies that show the level of overcrowding and the lack of sanitation facilities as being major determinants of child survival prospects (Timaeus and Lush 1995). The siting of migrant housing has also been shown to effect child and infant mortality, the economic inferiority of migrants forces them to occupy land more subject to physical and chemical hazards posed by the proximity of heavy industry, hence increasing the risks of respiratory infections (Brockerhoff 1995). Studies of urban anthropology suggest that migrants cluster together in urban enclaves, characterised by the informality of their housing. Given this concentration it seems plausible to suggest that the environmental conditions of migrant households are a prime factor in determining their health status (Rahman 1993).

Prasad and Somayjula (1992) demonstrate that the slum dwellers of Calcutta and Bombay experienced a severe lack of government health services. Although these cities are better equipped in terms of health services than the rural areas, the primary health care services appeared to be inaccessible to the poorer sectors of the urban society. Widespread unemployment meant that the private health facilities that were available were often unaffordable. This suggests that another cause of the higher mortality of the migrant population is their inaccessibility to urban resources, due not only to their location in the city, but also their inferior economic position. Indeed, a study of child birth practices in slum areas of Allahabad showed that a majority of women relied upon untrained health workers (Khandekar 1993), whom it was demonstrated were associated with higher rates of birth complications than trained government doctors.

Successful adaptation to the urban environment depends not only on the behaviour and social mobility of the migrant, but also the receptivity of the urban society (Brockerhoff 1994). The concentration of migrants in housing sectors with unfavourable environmental conditions, and their dependence on inferior health services indicates that many urban migrants have failed to assimilate into urban society. There are, however, a number of barriers that act to prevent the assimilation of the migrant population. The concentration of migrants in the low income and informal employment sectors creates a distinct underclass in urban societies, preventing migrants from making the transition to the full urban lifestyle. Abu-loghod (1966) notes the importance of social institutions in aiding the assimilation of migrants and the host population. However, the inherent cohesiveness of migrant populations, and the continued pattern of rural social institutions in urban areas results in a lack of social interaction between the migrant and urban populations. It is suggested that this process deters full assimilation, hence migrants remain in the unfavourable health environments of urban informal housing.

Sociological literature suggests the concentration of migrants in the lower socio-economic strata of urban society leads to the creation of a "culture of poverty", characterised by political dependency, alienation, apathy and psychological dysfunction among migrant families (Lewis 1966). The World Health Organisation recognised that such a process may have a major impact on the survival prospects of migrant children. It is suggested that this sociological environment leads to parental fatalism with respect to disease outcome, and inferior care or abuse due to family dissolution and the mental instability of the parent. However, little empirical evidence exists to support this, due primarily to the difficulties involved in collecting pertaining to such sensitive subject areas.

Brockerhoff (1995) notes that whilst many of the rural social institutions are transferred to the urban environment, migration does involve a freeing of the individual due to a gradual dissolution in parental and familial control. The result of this is an increase in adolescent and non-marital sexual activity, increasing the prevalence of single mother families in the migrant population. It is argued that the children of single mothers are more likely to experience the health disadvantages associated with low income, low maternal education and possibly social stigmatisation and discrimination. However, these results are based upon studies in sub-Saharan Africa. Given the religiosity of much of India's population it seems plausible to suggest that this process may not be as prevalent in the Indian migrant population.

3.4.1 Summary

The literature reviewed in this section has demonstrated that a relationship between migration and mortality does exist. Early epidemiological studies and historical literature suggested that this relationship took the form of an increase in migrant mortality with the move to a new health environment. However, recent studies on the developing world have highlighted a relationship of a more complex nature. It would appear that the transition from a rural to an urban environment in the developing world is associated with a decrease in mortality, from the high rates found in rural areas to rates that continue to be above the low rates of the urban host society. Evidence suggests that despite the duration of residence in an the urban area, the mortality of migrants continues to be above that of the urban natives. The available literature appears to agree on the causes of this urban mortality differential. The failure of the migrants to assimilate into urban society, due to their own economic position and the economic and social unreceptivity of the host society, creates a distinct health underclass. Children born in the two years prior to and after urban migration appear to have the greatest increase in mortality of all migrants, suggesting the dangers of the new urban environment to the young migrant.

The relationship between migration and mortality appears to be an area much neglected in demography, and the relationship detailed here is based on only a few available sources. Whilst information can be derived from historical and anthropological sources, these tend to concentrate upon macro-level factors and international migration. The available demographic literature on migration and mortality arises from the body of migration literature developed during the 1960s and 1970s. Given the ever evolving migration system of India, it seems plausible to suggest that such literature will not necessarily describe the mortality migration relationship in operation.

The work of Brockerhoff (1990: 1994) constitutes the only source of demographic literature on the contemporary child mortality and migration relationship. These studies used Demographic and Health Survey data from several West African countries, in order to ensure that the sample contained a large enough proportion of migrants to make analysis possible. Thus, the results and conclusions of these studies refer to several countries. This research, which will use the Indian National Family Health survey data, will thus constitute the first time that the relationship between migration and mortality can be quantified in India. Chapter 4 introduces the Indian

National Family Health Survey (1992) data, and presents the results of the logistic modelling of the impact of rural-urban migration on child mortality.

Chapter 4
Logistic Regression Modelling of Mortality

4.1 Introduction

This chapter constitutes the first stage in the analysis of the relationship between rural-urban migration and under-two mortality in India. The chapter begins with a discussion of the data set under analysis, describes the data collection, the data content, and the manipulation of the data sets. Secondly, the socio-economic composition of the migrant and non-migrant populations will be contrasted. Lastly, the method of analysis will be discussed, followed by the presentation of results, and a discussion of the main findings, and how they relate to previous research.

4.2 Sources of Migration Data

This section reviews the two potential alternative sources of data available for analysing the relationship between migration and mortality in India: the Indian Census and the National Sample Survey. The collection of migration data in India has changed greatly since Independence in 1947, and this chapter aims to illustrate how these changes have both increased and diminished the quality of data available. The relative advantages and disadvantages of each source are also discussed.

4.2.1 Census Data

Since 1871 the Indian census has continued to provide the principal source of data for the analysis of internal migration in India. However, the past four decades have witnessed the gradual evolution of the recording of migration in the census, with each successive census increasing the range of data collected. This section examines both this growth in census migration data, and its potential for analysing the migration and mortality relationship.

Censuses conducted between 1871 and India's Independence in 1947 did not provide any direct information on migration. A de facto system of enumeration was used, and place of birth was recorded by district rather than urban/rural classification. This de facto approach assumed that a person who had left their place of birth but happened to be at their place of birth at the time of enumeration was a non-migrant, thus perceiving migration as a life-time move. Given the circulatory nature of much of India's migration, this system of enumeration undoubtedly failed to record many of the short-term migrations that were occurring. Persons born in the district of enumeration were added to those who were enumerated in the district yet were born outside India (Willekens and Nair 1982). Hence, from the census tabulations it was impossible to establish the percentage of people in each district that were migrants.

In 1961 two new migration questions were introduced into the census. For the first time rural and urban classifications were given to both place of birth and place of enumeration, allowing the identification of migration streams between combinations of urban and rural areas (Srivastava 1972). This allowed inferences to be made on the levels of internal migration in the intercensal periods (Singh 1992). In addition, those born outside India were separated from those born in the district of enumeration, hence allowing the identification of international migration streams. A question relating to duration of residence was introduced, recording the last continuous period of residence in completed years. This facilitated the analysis of the permanency of migration, allowing the identification of short term moves between urban and rural areas. This question remains unchanged in the current census.

However, the 1971 census changed the definition of a migrant by recording the place of last residence, categorised as urban or rural, rather than the place of birth. This change to the method of recording migration data made comparison with the 1961 census data inaccurate, and disrupted the analysis of intercensal migration trends. However, the tabulation of migrants by age-group and marital status in the 1971 census allowed migrants to be analysed according to their demographic characteristics for the first time.

The censuses of 1981 and 1991 included questions on the reasons for migration in five categories: employment, family moved, migration, marriage, and other. These reasons were tabulated by age-group to allow the analysis of the motivations for migration over the life-span. However, the rather broad category of "other" continues to account for more than forty percent of all migrants, and this limits it's use in highlighting the behavioural aspects of migration. The 1981 census also collected data on migrant fertility, although this was carried out on a sample basis over several states. A 20% sample was selected by systematic sampling of the total number of enumeration blocks in each selected state, and data was presented at the district level (Padmanabha 1981). However, similar data on the experiences of infant mortality among migrants was not collected.

Indian census data constitutes the basis for much of the available literature due primarily to the lack of empirical studies on internal migration in India. The data available from the census allows the identification of flows of both inter and intra-state / district migration, and the categorisation of place of birth allows the study of movements between rural and urban areas. The changing definitions of migration have resulted in the incomparability of data from successive censuses. Aside from definitional changes, there are other reasons why it is not always possible to compare the results of successive censuses. The changing administrative boundaries within India have artificially increased the number of migrants. For example, between 1971 and 1981 the number of districts in India was increased from 360 to 412, thus the percentage of the population classified as having crossed boundaries would be inaccurately increased (Skeldon 1986). In 1981 the census was unable to enumerate the state of Assam due to political reasons, thus making the total migration numbers incomparable to those of 1971 and 1991. Most of the available literature infers migration from the census question on place of birth which may act to underestimate the true levels of migration (Smita and Chandna 1991). In India there is a strong tradition of females migrating from their natal home to that of their spouse upon marriage, and returning home for a period of confinement, thus many of these smaller moves may be eliminated if using only data on the place of birth. Also, the difference in the place of birth and the place of enumeration gives no indication of the number of movements made in between. Given the circulatory nature of much of India's migration, this will act to significantly reduce the number of migrations recorded.

4.2.2 Survey Data

Census data is limited in its breadth and depth. The data available from the Indian census, like most censuses, is insufficient to allow a full investigation of the determinants and consequences of migration, and it is not possible to establish migration differentials in socio-economic indicators (Bilsborrow 1981). For this type of analysis individual, household and community level data are required that can be linked and analysed simultaneously (Verma 1979). Such data are obtainable through sample surveys.

Initiated as a comprehensive fact-finding government agency in 1947, the National Sample Survey (NSS) aimed to collect individual level data on a range of socio-economic and demographic indicators of the country. The survey takes place annually, although migration data was not collected until the ninth round in 1955 (Das and Bhattacharya 1977). However, the survey failed to collect migration data in round 10 (1956). Reasons for this are not provided in any of the reports accompanying published data tables. Hence, the National Sample Survey is not able to provide complete time series data on internal migration in India.

The National Sample Survey collects a greater range of migration data than the census, collecting data on reasons for migration, the number of dependents for each migrant, seasonal migration, remittances, and economic activity prior to and in the year post migration. Thus, the NSS has the potential to provide a source of data to allow the analysis of the socio-economic characteristics of migrants, and to examine the role of economic forces in migration behaviour.

However, the NSS has consistently changed the definition used to identify migrants thus, although the data may be used to analyse migration trends in a particular year, comparisons with other years are often inaccurate. In rounds 9 to 13 a migrant was considered as one who was enumerated at an address other than their "native place", which may or may not be their place of birth. Subsequent rounds used place of birth and place of enumeration to establish migration status. The practice of marriage migration was not recorded until round 13, whilst rounds 9 to 12 only enumerated labour migrants (Chaterjee and Bose 1977). As a consequence of this changing definition of migration it has become difficult to establish trends in migration from the NSS data. For example, round 14 of the NSS used place of residence one year prior to the survey as the criterion for identifying a migrant, and as a result 3.5% of the urban population were recorded as migrants. However, the definition of a migrant was changed for round 15, this time using the previous place of residence to establish migration status. The percentage of the urban population classified as migrants subsequently increased to 41%. This definition continued until round 18 of the NSS which returned to the migrant definition used previously in round 14, and the percentage of the urban population categorised as migrants declined to 2.5% (Willekins and Nair 1982). This example illustrates the problems of using the NSS data for analysis. Whilst it contains individual level data not found in the census, the constantly changing definitions used have resulted in the creation of inaccurate migration trends. If we are to assess the impact of migration on mortality then it is important that we are able to correctly identify the migrant population.

This section has shown that, although the past four decades have witnessed attempts to increase both the range and quality of migration data in the census, it remains deficient in that the individual and household level data needed are unable to be linked and analysed simultaneously. In addition, the decennial nature of the census limits the number of migrations that are recorded. Migrations are not measured as they occur, but are identified by comparing place of residence at two consecutive time points, hence the census fails to record many short-term migrations. This method results in the recording of only those migrations that involve a change in place of permanent residence, eliminating circular or seasonal migration (Willekens and Nair 1982). Although for the purpose of this research, which concentrates on rural-urban permanent migration, such migration data would be sufficient, the inability to link individual and household level data limits the analysis of the determinants of mortality.

The NSS contains many of the required socio-economic indicators, but the constantly changing definitions of migration status have made the identification of migrants somewhat unreliable and the data between surveys incomparable. However, the main reason for not using the NSS is not the changing definition of migrants, as the migration data provided by a single round of the NSS would be similar to that available in a cross-sectional survey such as the 1992 National Family Health Survey. Chandrasekhar (1972) reports that the presence of non-sampling errors in the National Sample Survey data act to grossly under-estimate the true levels of infant and child mortality, and that this data may not be a true reflection of the mortality patterns present in the total Indian population. Therefore, these errors in the NSS data make the data set unreliable for the analysis of infant and child mortality in India.

The 1992 Indian National Family Health Survey (INFHS) collected data on socio-economic indicators at both the individual and household level. Although migration histories were not collected, using data referring to the previous and current places of residence (categorised as urban / rural) and the duration of residence, it is possible to identify those women who have migrated between rural and urban areas in the ten years prior to the survey. Hence, the Indian National Family Survey provides a range of demographic, socio-economic and health related data, at both the individual and household levels, that can be linked to the individual migrant, thus facilitating the analysis of the relationship between migration and mortality in India.

4.3 The Indian National Family Health Survey Data

The data set used for this analysis is the Indian National Family Health Survey (INFHS), conducted between 1992-1993. The target population for the survey was ever-married women aged 13-49. Data was collected for each of the twenty-four states of India and the National Capital Territory of Delhi, containing 99% of the total population (IIPS 1993). This resulted in the creation of 25 individual data sets, with a total sample size of 89,777 ever-married women. Because of the scale of this undertaking, the data collection was carried out in three phases between 1992 and 1993.

The principal aim of the INFHS was to provide state-level and national-level data on fertility, nuptuality, family size preferences, knowledge and practice of family planning, the potential demand for contraception, the level of unwanted fertility, child nutrition and health, and infant and child mortality (IIPS 1993). Three types of questionnaires were employed: the household, the village, and the individual woman's questionnaire, and these were uniform across states in order to facilitate inter-state comparisons.

4.3.1 The Questionnaires

The content of the questionnaires was based upon the DHS model B questionnaire, designed primarily for use in countries with low contraceptive prevalence. However, additions and modifications were made to the model B questionnaire by the International Institute of Population Sciences, Mumbai, in order to take into account the specific objectives of the INFHS and to reflect the socio-cultural milieu of India. In addition to the standard set of questions asked in all 25 states, certain states had state-specific questions, collecting data on the knowledge of AIDS and preference for sex of child. This analysis uses the data for all twenty-five states combined into an all-India data set, thus the state specific questions have been ignored in order to ease the combination of the states (19 of the states included state-specific questions).

The household questionnaire collected information on all usual residents of each sampled household, plus all visitors who slept in the household the night before the interview. In total 80,652 households were sampled. Data were collected on the characteristics of each person listed (age, sex, marital status, education, and relation to head of household). In addition, data on socio-economic status and household conditions were collected (for example: type of toilet facility, source of water/lighting, ownership of consumer goods and agricultural land). Household birth and death records were also collected, with all births and deaths in the two years prior to the survey recorded. The primary aim of the household questionnaire was to identify eligible women (aged 13-49) for the individual level woman's questionnaire.

The woman's questionnaire provides the main source of data for this analysis. In total, 89,777 ever-married women aged between 13-49 years were interviewed for the INFHS. The individual level questionnaire collected data in seven sections: respondent's background, reproduction, contraception, health of children, fertility preferences, husband's background and woman's work, and heights and weights of children. As the focus of this research is child mortality, only those sections of data relating to the respondent's background (socio-economic and demographic characteristics), reproduction (birth histories and use of ante-natal care services), health of children (death histories, immunization, disease histories, and breastfeeding), and husband's background and woman's work (husbands age, education etc) were retained for analysis. It is important to remember that all data used in this analysis refers to the female member of the household, and so any relationships found between migration and mortality will be influenced by the motivating factors behind migration that are specific to females. This issue is discussed further in Section 4.7.

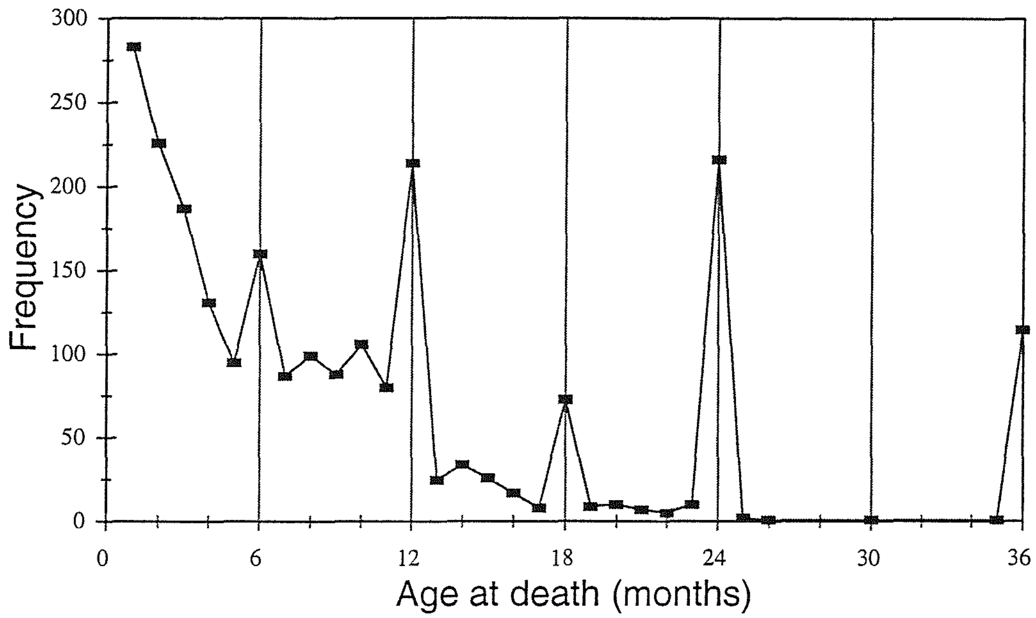
The village questionnaire was used to collect information on various amenities available in all villages covered in the INFHS (electricity, water, transportation, educational and health facilities). The village level data will not be used in this analysis for two reasons. Firstly, at the time of the initial analysis the data was not available in a format compatible with the household and woman's level data, and re-formatting would have substantially increased the time needed for analysis. Secondly, the research focuses on the mortality differentials between rural-urban migrants and non-migrant populations, yet the village questionnaire provides data only for rural areas, thus this third level of data is not available for all respondents (those in urban areas).

4.4 The Analysis Sample

The analysis of mortality focuses on children under two years of age, divided into three categories: neonates (less than one month), early post-neonatal (1-7 months), and late post-neonatal / toddler (8-24 months). The reasons for this division are two-fold. Firstly, the data from the INFHS displays evidence of age-heaping in the mother's reporting of the age of death of the child. Figure 4.1 shows the distribution of the reported age at death (in months), and it is apparent that there is substantial heaping in six month intervals (6, 12, 18 and 24 months). This suggests some element of recall bias in the mothers reporting of the age of death of the child, indicating the practice of digit-preference for six month intervals. The INFHS recorded age of death of the child in months up to 24 months, and in years beyond this. Figure 4.1 shows heaping at age 36 months, a product of this method of the recording of age at death. In order to surmount these problems age groups have been chosen that include the age heaps, the 8-24 month category includes the heaps at 12 and 18 months, thus removing the problem of having to decide what the real age at death of these heaped children would be. Although there is an age heap at 24 months, this has been included in order to provide a larger sample of deaths to model.

Models were also fitted for the age group 8-23 months, thus removing the age heap at 24 months. These models showed no difference to the results produced by the modelling of the 8-24 month category. The results presented in this analysis thus refer to the age group 8-24 months. By truncating the analysis at two years the research concentrates only on those whose age at death is given in months, hence providing a potentially more accurate indicator of the timing of the child's death than the rather crude recording of age at death in years.

Figure 4.1: Reported age at death in months (excluding neonates)



The second reason for the choice of the mortality periods under analysis is the recognition of the changing determinants of mortality with age of the child. Demographic and medical literature continues to show that the determinants of child mortality change considerably with the increasing age of the child. The World Health Organization (1986) argues that neonatal deaths are primarily the product of the bio-demographic characteristics of the mother and the pregnancy (mother's age at birth, prematurity, size of child at birth, and place of birth). Mortality occurring at ages above the neonatal period has been shown to be associated with socio-economic, health utilisation, and environmental factors (Mosley and Chen 1984). Hence, by dividing the mortality into three periods the research recognises that the determinants of mortality are not uniform with the age of the child.

The INFHS data was made available in 25 individual data sets, representing the individual states. In order to ensure that enough migrants were included into the sample, and to facilitate inter-state comparisons, the data sets were combined into one all-India data set, comprising of 89,777 individual and 80,562 household interviews. The original individual level data came in a "woman-file" format, where each line of the data represented the responses of an individual woman. However, the data set for Punjab included 11 multiple entries, and these were deleted from the data set. The data was transformed into child-file format, so that each line of the data represented the information associated with each individual child (hence, the information for the mother was repeated for each of her children). Similarly, the household level data set, in which each line was a household, was changed into a child format. The result of this was the creation of an all-India child file with 275,172 cases. This sample size was then reduced to include only those born in the five years prior to the survey. The main reason for the choice of this period was to reduce the biases created by changing period rates of mortality and to reduce the influence of maternal recall bias. Curtis (1992) in a study of infant mortality in Brazil, argues that analysis can be affected by the presence of period changes in mortality, distorting the estimated effects of the covariates if data referring to a large time period are used. Given the changing rates of infant and child mortality in India (as discussed in Chapter 2) reducing the analysis period to five years should act to reduce this potential bias. In addition, the INFHS asked questions relating to the uptake of maternal and child health care services only for those children born in the five years prior to the survey, and only for up to three children. The potential importance of these data in estimating the determinants of mortality is the second reason for reducing the sample to those children born within five years prior to the survey. The analysis focuses on the period 1988-1992, using a sample size of 61,722 children aged under five years.

Table 4.1 Data sets used for logistic modelling of under-two mortality

	Neonatal (0-1)	Early post-neonatal (1-7)	Late post-neonatal / toddler (8-24)
Original sample	61 722	61 722	61 722
Original no. Deaths	2714	1082	1114
Number of cases excluded due to incomplete exposure	591	10 040	28 491
Number of deaths excluded due to incomplete exposure	22	100	234
Number of deaths excluded as died in previous mortality period	0	2368	2241
Number of deaths in censored data	2692	982	880
Censored sample size	61 131	51 682	33 231
Censored mortality rate (per thousand)	44.0	19.0	26.4

Table 4.1 shows the process by which the final data sets for analysis were created. Three data sets were produced, one for each mortality period under analysis. Each data set began with 61,722 cases, the total number of children aged under five in the INFHS data set. The number of deaths in each of the periods are shown, producing mortality rates of 43.9 deaths per thousand live births (neonatal period), 17.5 deaths per thousand live births (early post-neonatal period), and 18.0 deaths per thousand live births (late post-neonatal and toddler period). Rutstein (1985) notes that the use of birth history data for the analysis of mortality incurs bias in the form of censoring of exposure to death by the interview. In order to surmount this problem, all those cases who have incomplete exposure to the full period under analysis are removed from the data set. Thus, the data set for the period 7-24 months has all those aged less than two years removed, as they have not completed full exposure to the period under analysis. Table 4.1 shows the number of cases removed and the number of deaths lost for analysis by this process. Deaths occurring in the previous mortality period must also be removed, for example, all neonatal deaths are

deleted from the early post-neonatal period data set. As a result the three data sets under analysis are as follows. The neonatal period includes deaths to those aged less than one month, with a sample size of 61,131, and refers to all those born between one month and five years prior to the survey. The early post-neonatal period includes deaths to those aged 1-6 months, with a sample size of 51,682, and refers to those born between six months and five years prior to the survey. Finally, the late post-neonatal and toddler period includes deaths to those aged between seven and twenty four months, sample size 33,231, and refers to those born between two and five years prior to the survey (births between 1988-1990).

4.5 The Migrant Population

Previous attempts to quantify the relationship between migration and mortality have used aggregated data from several countries, to ensure enough migrants in the sample (Brockerhoff 1990: 1994). The use of the combined Indian National Family Health Survey data achieves this aim and manages to contain the research within a single country. For the purpose of this research a migrant is defined as a respondent who has moved between any combination of rural and urban areas in the last ten years. This definition was used partly due to the limited information collected in the INFHS on migration. Migration histories were not collected, and thus questions relating to the number of years spent in the respondent's current place of residence, and the type of both the previous and current place of residence (rural or urban) were used to establish migration status. Using this information it was possible to identify four migration streams: those who had moved from rural to rural areas, urban to urban, rural to urban, and urban to rural. The level of rural to urban migration India is still relatively low (see Chapter 3), and the use of a ten year window for migration maximises the number of rural-urban migrants included in the analysis sample.

Table 4.2 Distribution of analysis sample by migration status

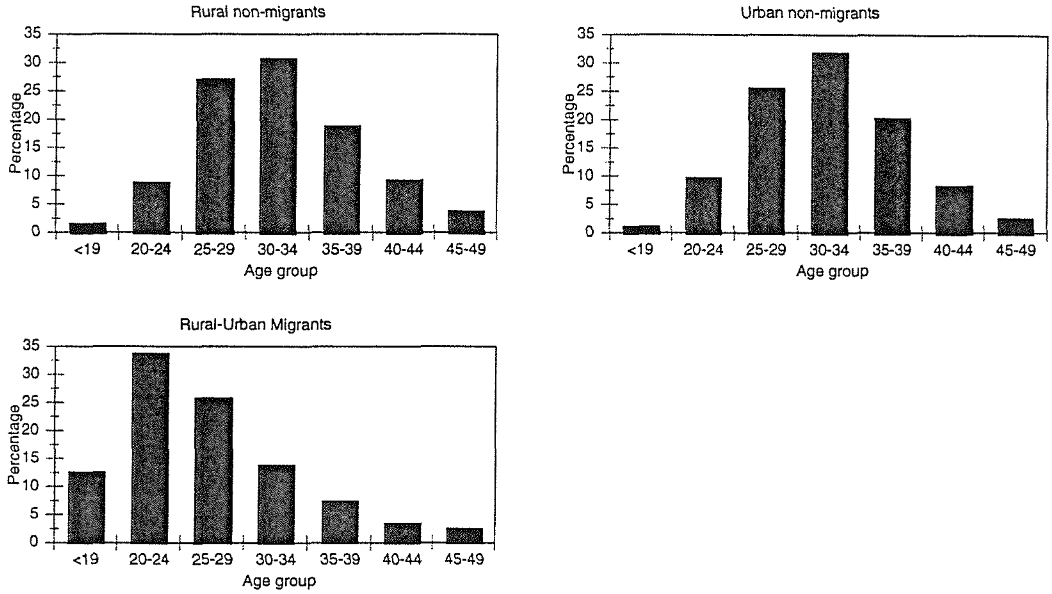
Age of child			
Mother's migration status	Neonatal (%)	Early post-neonatal (%)	Late post-neonatal and toddler (%)
Urban Non-Migrant	6731 (11.0)	5809 (11.2)	3925 (11.8)
Rural Non-Migrant	21 360 (34.9)	18 107 (35.0)	12 322 (37.1)
Rural-Urban Migrant	4929 (8.1)	4205 (8.1)	2613 (7.9)
Other Migrant*	28 111 (46.0)	23 561 (45.6)	14 371 (43.2)
Total	**61 131 (100.00)**	**51 682 (100.00)**	**33 213 (100.00)**

* Other migrant refers to remaining combinations of rural and urban: rural-rural, urban-urban, and urban-rural.

Table 4.2 displays the distribution of the three analysis samples by migration status. The cases are the children of migrant and non-migrant mothers. As the focus of this research is the impact of rural to urban migration on child mortality, a variable was created categorising the sample into urban non-migrants, rural-non migrants, and rural to urban migrants, hence allowing the comparison of migrants with those in their origin and destination. Migrants taking part in the remaining streams (rural-rural, urban-urban, and urban-rural) are referred to as 'other migrants'. From Table 4.2 it is apparent that approximately 8% of the samples are rural-urban migrants, compared to approximately 10% in the general Indian population in 1990 (Mehta 1990 using Census data from 1981), hence suggesting the representative nature of the data.

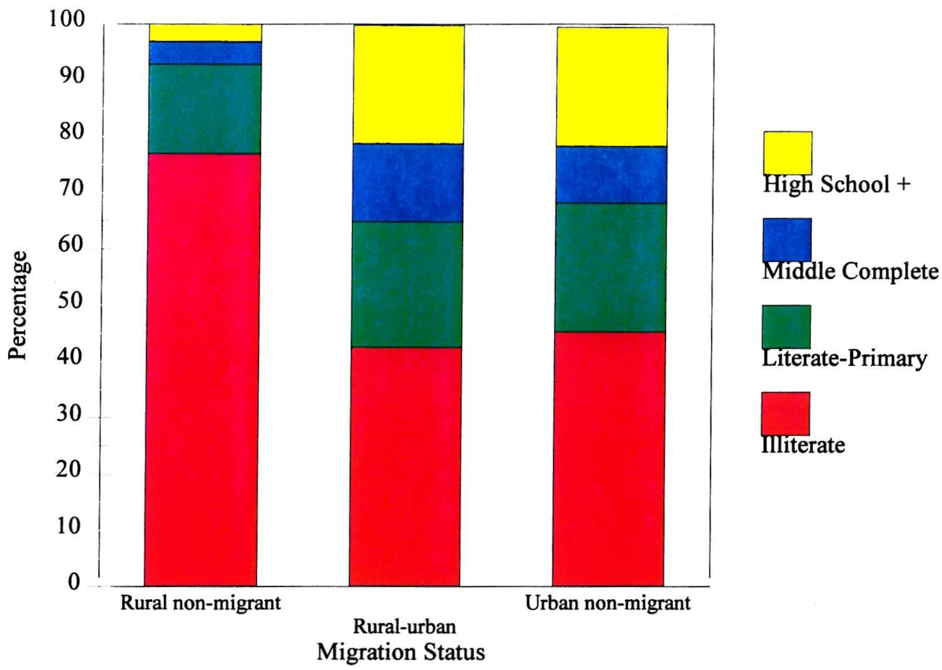
Migration theory suggests that rural to urban migration is selective of those with certain socio-economic and demographic characteristics. Figure 4.2 displays the age structures of the migrant and non-migrant populations. It is apparent that the age structure of the non-migrant populations displays a different pattern to that seen in the rural-urban migrant population. Migrants are concentrated around the age range 20-29 years, whilst the non-migrant populations show an approximately similar distribution across all age groups sampled (13-49). Oberai and Singh (1981) note that the selective migration of those aged between 20-35 years is a common factor in all Indian migration streams, hence suggesting that the trends witnessed in the INFHS reflect those in the general Indian population. This selectivity of the younger ages is attributed to the economic motivations behind migration which it is proposed are stronger in the younger age groups (see Chapter 3).

Figure 4.2 Age distribution of rural-urban migrant and non-migrant populations



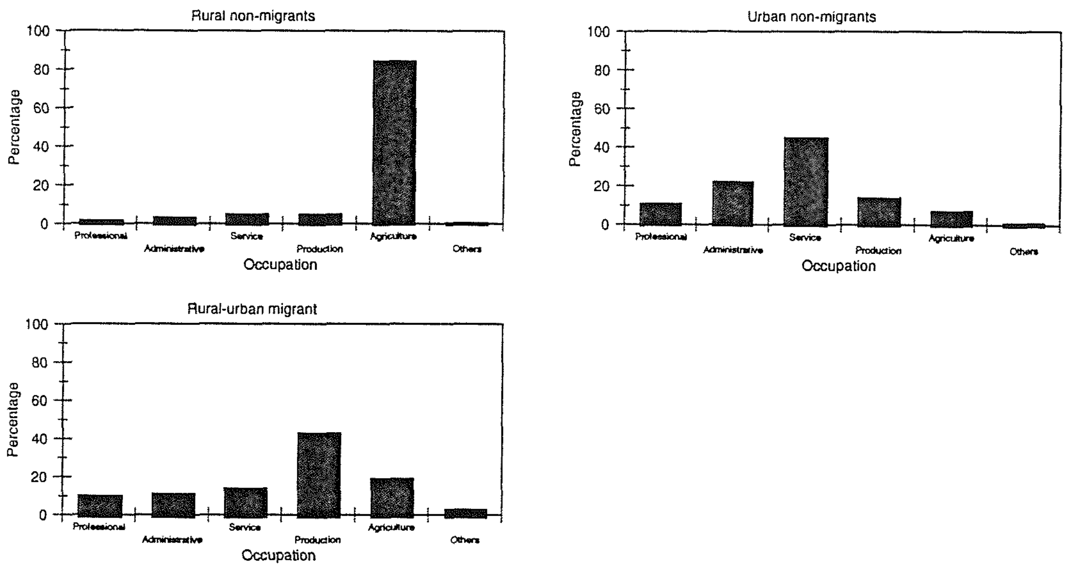
Migration is selective of those with higher educational attainment. Figure 4.3 displays the rural-urban migrant and non-migrant populations categorised by level of educational attainment. It is apparent that there are close similarities in the distribution of educational attainment between the urban non-migrant and rural-urban migrant groups, with both having more than 50% of their populations achieving some level of formal education. In contrast, the rural non-migrant population is characterised by a high level of illiteracy and a low percentage of the population achieving education above primary level. Connell et al. (1976) noted that migration in India is selective of both the least and most educated. It was suggested that for the most educated, migration provides the potential to increase economic opportunities, whilst for the least educated migration acts as a survival strategy through an attempt to gain employment away from rural areas. This may explain the educational patterns witnessed among rural-urban migrants in the INFHS data. Urban areas appear to attract both the illiterate and highly educated, suggesting these areas have economic attractions for those in the extreme educational groups.

Figure 4.3 Rural-urban migrant and non-migrant groups by educational attainment



The explanations of the educational selectivity of migration, that it is a product of the economic motivations for migration, are reflected in the employment structures of the migrant and non-migrant populations (Figure 4.4). The rural non-migrant population is dominated by employment in the agricultural sector, reflecting the importance of the agrarian economy in rural areas. The urban non-migrant population has a higher percentage of its population categorised in the professional and service sectors than both the rural non-migrants and the rural-urban migrants, suggesting the economic superiority of this group. In contrast, rural-urban migrants are concentrated in the service and production sectors of employment, suggesting their lower economic status relative to the urban non-migrants. The distribution of migrants over a number of employment areas in the rural-urban stream indicates the different types of migrant that urban areas attract from the rural origin.

Figure 4.4 Employment structure of rural-urban migrants and non-migrants



A standard of living index (SLI) was created as a measure of the socio-economic position of the respondent's household. The index was created using variables relating to the household structure, facilities available in the household, and ownership of consumer goods and agricultural land. Each variable was attributed with a score related to its relative desirability in the household (for example, a piped water source was given a higher score than public well sources). The scores for each variable were cumulated for each household. The potential maximum score was 74, and a potential minimum 31. Categories were created as follows: rich (65+), upper middle (55-64), middle (45-54), lower middle (35-44), and poor (<35). A final category of 'incomplete' refers to those who did not have recorded information on all the variables used in the index (352 cases, representing 1.1% of the sample). Appendix 4.1 gives a full description of the method used to create the SLI and the scores given to each variable.

Figure 4.5 shows the migrant and non-migrant populations by the standard of living index. Again it is apparent that the rural-urban migrants are economically superior to those in the rural origin (having higher percentages of those classified as rich and upper middle). This is undoubtedly both a consequence and a reflection of the educational and employment distributions of these two groups. The distribution of the SLI displays only small differences between the urban non-migrant and rural-urban migrant group. Demographic literature continues to stress the importance of characteristics of socio-economic status as determinants of child mortality. Given the economic differentials between the migrant and non-migrant populations indicated by the SLI, it would seem plausible to suggest that we may expect to find differential survival between the migrant and non-migrant populations, with the greatest differences observed between rural-urban migrants and rural non-migrant groups.

Figure 4.5 Rural-urban migrant and non-migrant populations by standard of living index

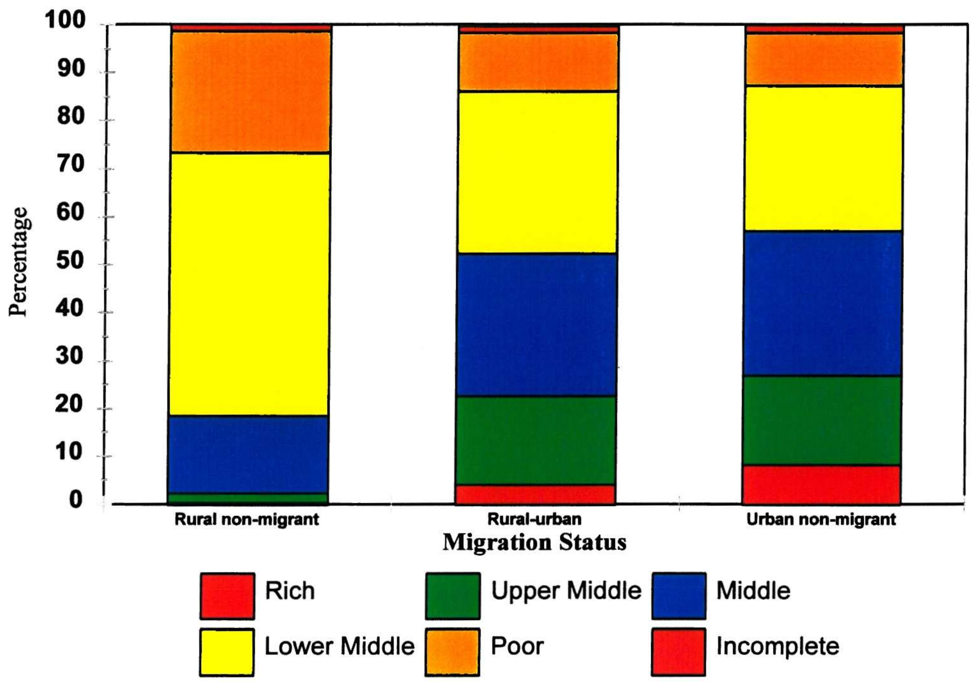


Table 4.3 presents the distribution of the migrant and non-migrant population by caste and religion. Seventy-four percent of the INFHS respondents were from 'other' castes, and Table 4.3 shows that they are the dominant group in each of the migration streams. There appears to be no differences in caste composition between any of the migrant and non-migrant groups, indicating that none of the forms of migration are caste selective. However, the caste groups used in the INFHS are very broad, each one including many smaller castes, and thus it is difficult to conclude any caste-wise trends from this data. Similarly, each of the groups is dominated by Hindus, who comprise 76% of all INFHS respondents. The distribution of migrants by religion in approximately equal in all groups,

suggesting that migration is not selective of any religion

Table 4.3 Migrant and non-migrant populations by caste and religion

	Non-migrants	Rural-urban migrants	Rural-rural migrants	Urban-rural migrants	Urban-urban migrants
Total	58771	4898	18481	1963	5664
Caste					
Scheduled caste	6825 (11.6)	512 (10.4)	2557 (13.8)	188 (9.5)	392 (6.9)
Scheduled tribe	7783 (13.2)	235 (4.7)	2466 (13.3)	130 (6.6)	165 (2.9)
Other	44163 (75.1)	4151 (84.7)	13458 (72.1)	1645 (83.8)	5107 (90.1)
Religion					
Hindu	45320 (77.1)	3929 (80.2)	14809 (80.1)	1546 (79.6)	4474 (78.9)
Muslim	6364 (10.8)	499 (10.1)	1822 (9.8)	189 (9.6)	611 (10.7)
Christian	5861 (9.9)	398 (8.1)	1558 (8.4)	189 (9.6)	415 (7.3)
Other	1222 (2.0)	71 (1.4)	292 (1.5)	39 (1.9)	163 (2.8)

From this initial description of the migrant and non-migrant populations it can be seen that the two populations differ in their socio-economic composition, with noticeable educational and standard of living differentials. The rural-urban migrant population, the focus of this research, appears to contain both extremes of the socio-economic indicators, with both highly educated and illiterate respondents reporting migration between rural and urban areas. In comparison, the non-migrant populations appear to be more homogenous, with high rates of illiteracy and a high percentage of those categorised as having low standards of living in the rural non-migrant population, and higher educational attainment and concentration in the professional and administrative sectors among the urban non-migrant population. From this initial comparison of the descriptive statistics, it seems plausible to suggest that there may be differing rates of child survival between the migrant and non-migrant populations.

4.6 Preliminary analysis

In the analysis sample there were 2,692 neonatal deaths, 982 early post-neonatal deaths, and 880 late post-neonatal and toddler deaths. This produced mortality rates of 43.6 per thousand live births (neonatal), 19.0 per thousand live births (early post-neonatal), and 26.4 per thousand live births (late post-neonatal and toddler) for those born during the period 1988-1992. Due to the periods used in this analysis there are no published mortality rates with which to compare the validity of the rates produced by the INFHS. However, the INFHS infant mortality rate of 78.5 per thousand live births compares favourably to that of 82.5 per thousand live births noted by the United Nations (1995). Hence, it would appear that INFHS data is representative of the general Indian population.

Table 4.4 displays neonatal, early post-neonatal and late post-neonatal and toddler mortality rates by potential explanatory factors. It is apparent that mortality differentials exist in all three periods between migration status. Rural-urban migrants have a neonatal mortality rate of 34.6 per thousand live births, in between that of the rural origin (45.5 per thousand live births) and the urban destination (34.1 per thousand live births). This pattern is present in all three mortality periods, and the differentials between migrants and urban non-migrants are larger in the later periods. This suggests that the process of rural-urban migration may be parallelled by a mortality transition, which results in the mortality of migrants decreasing from the levels in their origin, yet failing to assimilate with the mortality regime present in urban areas.

Mortality differentials are more striking by maternal eduction and the standard of living index. The highest rates of mortality are found among those mothers categorised as illiterate, with mortality rates declining with increasing levels of education. Those categorised as having the lowest standards of living have the highest rates of mortality in all three periods, and mortality rates decline as the standard of living increases. The relationships between child mortality and maternal education and the socio-economic environment are well documented in demographic literature (Cleland 1990, Basu and Basu 1991).

Table 4.4 Neonatal and post-neonatal mortality rates by selected explanatory factors (Rates are per thousand live births)

	Neonatal	Early Post-neonatal	Late Post-neonatal & Toddler
Total Rate	**43.6**	**19.0**	**26.4**
Migration Status:			
Rural-Urban Migrant	34.6	16.8	21.8
Urban Non-Migrant	34.1	13.2	17.8
Rural Non-Migrant	45.5	20.5	32.3
Other Migrant	46.9	19.5	24.6
Standard of Living Index:			
Rich	27.3	6.9	1.8
Upper Middle	25.7	10.6	8.7
Middle	32.5	14.2	16.2
Lower Middle	49.5	21.3	32.0
Poor	55.1	25.0	27.7
Maternal Education:			
Illiterate	52.1	23.8	36.1
Primary	34.2	13.7	17.4
Higher+	24.3	6.5	5.2

4.7 Methodology

The Indian National Family Health Survey (1992) collected data on seven subject areas (see Section 4.2), and thus contains a wide range of potential explanatory factors for mortality. The selection of variables to be analysed was based upon a combination of literature review and bivariate analysis. Literature notes that the determinants of mortality change with the age of the child, with a change from bio-demographic correlates in the early months, to factors associated with the physical and social environment in later mortality periods (Bhatia 1989; Padmanabha 1982). This research focuses on the mortality of those aged under two years, and thus the selection of variables was concentrated on those directly linked to pregnancy and child health, and those that were indicative of the socio-economic status of the household. Bivariate analysis was performed on thirty-nine selected variables, using the Pearson chi-square test for statistical significance between the dependent (mortality) and independent variables. A list of the variables used in the bivariate analysis can be found in Appendix 4.2. The chi-square tests found significant relationships between mortality and each of the independent variables in each of the three mortality periods analysed. This suggests that under-two mortality is influenced by a large number of factors, representing bio-demographic, socio-economic and health care utilisation factors. However, the chi-square tests only examine the relationship between mortality and an independent variable, without controlling for the presence of other influential factors. Hence, the relationships observed in the bivariate analysis may not be present once other influences on mortality are controlled. The bivariate analysis thus acts as a method of establishing potential determinants of mortality, and the logistic and multi-level logistic modelling of mortality (presented in Chapter 5) will examine the importance of these variables as determinants of mortality, whilst allowing for the confounding effects of other variables.

This research focuses on rural-urban migration. Age at migration was calculated by selecting the rural-urban migration stream and subtracting the number of years resident from their age at the time of the survey. By using age at marriage it was possible to identify those who had migrated before or after marriage, by subtracting age at time of the survey from age at marriage to determine duration of marriage, and then subtracting this from duration of residence. Those for whom this equalled zero were assumed to have migrated at the time of marriage. This variable was created in order to examine the influence of marriage migration on infant and child mortality. It is postulated that those who migrated at the time of marriage are marriage migrants, and thus have a different set of motivating factors for migration than those migrating before or after marriage.

A similar method was used to establish whether a child was born before or after migration (using age of the child at the time of the survey, the date of birth, and the duration of residence). This variable was created to examine how exposure to the mortality regime before migration may have influenced mortality outcomes after migration. It would seem plausible to suggest that an infant exposed to the high rural mortality regime before migrating to an urban area may have differing survival prospects to an infant born into the urban mortality regime.

Logistic regression models were fitted in each of the mortality periods using a dichotomous dependent variable which measures whether a child died or not (0= not dead, 1= dead). Logistic regression models the relationship of several independent variables, which can be either categorical or continuous, to a dichotomous dependent variable using a mathematical model (Kleinbaum 1994). The model may be written as follows:

$$\text{logit}\ (p_i) = x'_i\beta$$

Where $\mathbf{p}_i$ is the probability of the ith child dying during the specified mortality period, $\mathbf{x}_i$ is a vector of covariates associated with the ith child, and $\boldsymbol{\beta}$ is a vector of unknown parameters. This model assumes that the observations are independent, and that the variations in individual probabilities of death can be explained by the covariates in the model. In order to establish inter-relationships between variables interactions were fitted between independent variables which literature suggested may be correlated. Appendix 4.3 displays the interactions fitted in each of the mortality periods.

In total, 39 variables were selected for the logistic modelling of mortality. The variables selected can be categorised as bio-demographic, migration, socio-economic, health care utilisation, and geographic. Appendix 4.4 displays a full list of variables used as independent variables in each of the mortality periods. Variables which contained missing values were recoded. For example, the missing values in the birth interval variable were recoded as first births. For those variables where a missing value indicated failure to record the data, the missing values were recoded as "unknown", in order to assess whether these were significantly different from the remaining sample population. There were no missing cases in the response variables. Those categorised as 'unknown' for the independent variables were examined to see if they had socio-economic characteristics different to the total sample population. However, the distribution of socio-economic indicators proved to be similar in the 'unknowns' and in the total sample population.

4.8 Results of Logistic Modelling of Neonatal Mortality

Table 4.5 displays the results of the logistic regression modelling of neonatal mortality. In total 13 of the variables entered into the model proved to have a significant relationship with the risk of neonatal mortality (significant at the 5% level). The variables proving to be significantly related to mortality can be categorised as follows: bio-demographic, health utilisation, geographic, and socio-economic. However, the effect of each of these categories varied. In order to interpret the results, the beta estimates are exponentiated and interpreted as odds ratios. An odds ratio is the odds of mortality relative to those in the reference category. Odds ratios are identified by the initials *OR*.

Table 4.5 Results of Logistic Modelling of Neonatal Mortality

Variable	N	β	S.E β	Odds Ratio
Migration Variables:				
Migration				
Rural - urban migrant	4929			1.00
Urban	6731	0.102	0.127	1.10
Rural	21360	0.173	0.109	1.18
Other migrant	28111	0.240	0.103	1.27
Bio-demographic Variables:				
Mothers Age At Birth				
13- 19	15316			1.00
20-24**	23019	-0.618	0.155	0.54
25-29**	13887	-0.540	0.164	0.58
30-34	6055	-0.316	0.173	0.72
35-45	2854	0.054	0.127	1.05
Multiple Birth				
Single	60224			1.00
Multiple**	907	1.817	0.104	6.15
Sex of Child				
Male	31493			1.00
Female**	29638	-0.238	0.047	0.78
Premature Birth				
No	59391			1.00
Yes**	1714	2.171	0.068	8.76
Don't know**	206	0.793	0.315	2.21
Size of Child at Birth				
Large	9821			1.00
Average**	37743	-0.305	0.073	0.73
Small**	13747	0.369	0.076	1.44
Birth Interval & Survival Status Of Previous Child				
Alive & < 18 months	4181			1.00
Alive & 18-36 months **	19089	-0.425	0.095	0.65
Alive & 36+ months **	14852	-0.655	0.102	0.51
Dead & < 18 months **	1644	0.677	0.119	1.96
Dead & 18-36 months	2421	0.196	0.125	1.21
Dead & 36+ months **	1355	-0.510	0.187	0.60
First birth	17589	0.069	0.095	1.07

Continued over page

Variable	N	β	S.E β	Odds Ratio
Socio-Economic Variables:				
Mothers Education				
Illiterate	35961			1.00
Primary	16410	-0.100	0.066	0.90
Higher + **	8760	-0.402	0.120	0.66
Household Density				
Very low	3316			1.00
Average**	44254	-0.505	0.096	0.60
High**	12823	-0.923	0.112	0.39
Very high**	918	-1.305	0.258	0.27
Source Non-drinking Water				
Other	43539			1.00
Public pipes**	17580	0.166	0.054	1.18
Standard of Living Index				
Rich	2009			1.00
Upper Middle	5390	-0.003	0.192	0.99
Middle	13028	-0.025	0.187	0.97
Lower Middle	28126	0.209	0.189	1.23
Poor	11954	0.299	0.196	1.34
Incomplete	624	-0.194	0.329	0.82
Health Care Utilisation Variables:				
Months Pregnant When Sought Ante-natal care				
<2	5743			1.00
3-4**	10214	0.384	0.120	1.46
5-6**	8483	0.493	0.124	1.63
7+**	5222	0.388	0.136	1.47
No ante-natal care**	31469	0.429	0.126	1.5
Received Tetanus Injection During Pregnancy				
Yes	37377			1.00
No**	23754	0.471	0.069	1.61

Continued over page

Variable	N	β	S.E β	Odds Ratio
Geographic Variables:				
State				
Kerela	2046			1.00
Andhra Pradesh **	2363	1.207	0.261	3.34
Assam **	2338	1.219	0.252	3.38
Bihar **	4502	1.268	0.246	3.55
Goa	1451	0.252	0.313	1.28
Gujarat **	2388	1.313	0.262	3.71
Haryana **	2273	1.140	0.267	3.12
Himachal Pradesh **	1859	1.035	0.270	2.81
Jammu and Kashmir **	1866	1.109	0.281	3.03
Karnataka **	2858	1.117	0.252	3.05
Madhya Pradesh **	2046	1.098	0.246	2.99
Maharashtra **	4719	1.026	0.262	2.79
Manipur	2623	-0.383	0.508	0.68
Meghalaya **	714	0.939	0.317	2.55
Mizoram	896	-0.431	0.626	0.64
Nagaland	597	-0.366	0.477	0.69
Orissa **	796	1.303	0.251	3.61
Punjab **	2856	1.220	0.279	3.38
Rajasthan **	1874	0.844	0.254	2.32
Tamil Nadu **	3470	1.209	0.261	3.35
West Bengal **	2130	1.214	0.251	3.36
Uttar Pradesh **	2834	1.408	0.238	4.09
New Delhi **	9785	1.248	0.272	3.48
Arunchal Pradesh	2385	0.083	0.387	1.08
Tripura **	800	1.096	0.318	2.99
Constant **		-4.117	0.376	

** $P < 0.05$

Migration status proved not to be significantly related to the risk of neonatal mortality after controlling for the other determinants of mortality. Using rural-urban migrants as the reference category, there was no significant difference in the risk of neonatal mortality between this group and non-migrants (urban and rural) and other migrants. The rates of neonatal mortality by migration status (see Table 4.4) show differential rates of survival between migrants and non-migrants, and bivariate analysis showed that migration status was significantly correlated with the risk of neonatal mortality. However, the neonatal mortality rates were similar for the rural-urban migrant and urban non-migrant groups, suggesting that the main differences in neonatal mortality are observed between urban and rural populations. Although not significant at the 5% level, the parameter estimates suggest that there are mortality differentials between migrant groups. Relative to rural-urban migrants, rural non-migrants display a greater odds of experiencing neonatal mortality (OR 1.18). However, the odds of mortality are also greater in the urban non-migrant group (OR 1.10), suggesting that Brockerhoff's (1994) three level relationship between mortality and migration is not in operation in the neonatal period.

Bio-demographic variables accounted for 7 of the 13 significant relationships in the neonatal period, and thus appear to be the most significant group of variables in determining the risk of neonatal mortality. Previous studies have demonstrated a U-shaped relationship between maternal age and the risk of neonatal morality (Sandhya 1991). It is hypothesised that biological immaturity at young ages (under 19) and depletion at older ages (over thirty-five) reduces the efficiency of the reproductive system in producing healthy babies (Madise and Diamond 1995; Ladislav 1972). Table 4.5 shows that the age groups 20-24 and 25-29 had significantly lower risks of neonatal mortality than the reference category of those aged under-19. The percentage decrease in the risk of mortality increased with age, such that those in the 20-24 age group had 46% less mortality than the reference group, compared to 42% in the 25-29 group and 36% in the 30-34 age group. There was no significant difference between the older age groups and those aged under-fifteen. Literature suggests that the ages between 20-29 are the safest in terms of producing children of a healthy birth weight and hence those with the greatest survival prospects (Badari 1983). The results found in this model would thus appear to be in accordance with those found in previous empirical studies.

Prematurity and the size of the child at birth both proved to be significant risk factors for neonatal mortality. Premature births were more than eight times more likely to result in neonatal death (OR 8.76) than full-term babies, whilst those born to mothers who were unsure of the prematurity status of the child were twice as likely to die in the neonatal period (OR 2.21). The INFHS did not record birth weight, but instead asked the mother her opinion on the size of the child at birth. Birth weight has consistently been shown to be a determinant of neonatal mortality (Belsey and Royston 1987), and thus, despite the potential subjectivity of this variable, it was used as a proxy for birth weight. A J-shaped relationship appears between mothers opinion about the size of the child at birth and the risk of neonatal mortality. Using those babies deemed large in size as the reference category, the odds of mortality for average sized babies were 23% lower, and for small babies were 44% higher. Both prematurity and low birth weight have been shown to be indicators of poor maternal nutritional status (Gandotra, Das and Dey 1982). In addition, the under-utilisation of ante-natal care may result in the failure to monitor foetal growth and detect any abnormalities of development (Chandrasekher 1972), hence increasing the possibility of low birth weight or premature babies. The significance of these variables indicate the importance of maternal nutritional status and the utilisation of ante-natal care in determining the survival prospects of neonates in India.

Female neonates were shown to have a lower risk of death than their male counterparts, with an odds ratio of 0.78. This finding is consistent with the wealth of medical and demographic literature which states that the stronger biological constitution of female babies increases their survival prospects during the neonatal period relative to that of male babies (Bhatia 1989: Ram et al 1983). The proposed sex differential in mortality in favour of the male child (Basu 1990: Badhai et al 1983) does not appear to be in operation in the neonatal period. Multiple births proved to be six times more likely to result in a neonatal death than singletons (OR 6.15). It is suggested that this is a product of the increased likelihood of childbirth complications associated with multiple births and their greater susceptibility to low birth weights (Gandotra, Das and Dey 1982).

The detrimental effects of short preceding birth intervals on the survival prospects of the index child are well documented in the demographic literature (Srivastava 1990; Hobcraft, McDonald and Rutstein 1984). Two possible mechanisms have been proposed to explain this relationship. Firstly, that of maternal depletion syndrome, in which repeated pregnancies and short birth intervals reduce the ability of the mother to recover physically and nutritionally from pregnancy (particularly where malnutrition is prevalent), hence increasing the prospects of producing premature or low birth weight babies (Srivastava 1990). Secondly, short birth intervals increase the levels of competition between siblings, with older siblings taking precedence in the distribution of resources (Maine and McNamara 1985).

The model of neonatal mortality includes a significant interaction between preceding birth interval and the survival status of the previous child. Using the scenario in which the previous child was still alive and the birth interval was less then 18 months as the reference category, lower risks of mortality were found among those where the previous child was still alive yet the birth intervals were longer (18-36 months OR 0.65, 36 months+ OR 0.51). However, if the previous child was dead and the birth interval was less than 18 months the odds of mortality was almost twice as high (OR 1.96) than if previous child had been alive. As the birth interval increased to 18-36 months, the risk of dying in the neonatal period was still higher for those whose previous child was dead than those with a living previous child and a birth interval of less than 18 months (OR 1.21). For those with a birth interval of over 36 months and whose previous child died the risks of mortality were lower than the reference category (OR 0.60). This interaction demonstrates two important relationships between neonatal survival and the preceding birth interval. Firstly, short birth intervals (less than 18 months) are associated with a higher risk of mortality than those between 18-36 and over 36 months, and the risk of mortality appears to decline as the birth interval increases. Secondly, if the previous child has died, the risk of mortality is higher than if the child had been alive, even with birth intervals of up to 36 months. The presence of multiple neonatal deaths in a family may also indicate a genetic propensity for congenital birth defects.

Environmental and socio-economic variables combined to account for only 3 of the 13 significant correlates of neonatal mortality. Household density (the number of people per room) and the household source of non-drinking water proved to have significant relationships with the risk of neonatal mortality. A negative relationship was found between household density and neonatal mortality, with the risk of neonatal death 72% lower in households with a very high density (over 6 people per room) relative to those households with a very low density (less than 3 people per room). This finding is in opposition to literature which suggests that household over-crowding has detrimental effects on infant survival, acting to increase the risk of transmission of infectious diseases (Timeaus and Lush 1995). One potential explanation is that the large number of adults living in a crowded house may provide a greater opportunity for child care than can be found in a less crowded household, and that the neonate may benefit from the child care experience available from other adults present in the household. It was found that those households drawing non-drinking water from public pipes had an 18% higher risk of experiencing neonatal death than those utilising other sources (own pipes, wells, and water tanks). Table 4.5 shows that the standard of living index, calculated to measure the socio-economic status of the household, was not significantly related to neonatal mortality. This demonstrates the low impact that environmental and socio-economic factors have on neonatal mortality, which would appear to be largely determined by bio-demographic factors.

Maternal education was shown to be significantly related to the likelihood of neonatal mortality. Those with higher education and above had 34% lower risk of neonatal mortality than the illiterate group (OR 0.66). However, no significant difference in the risk of neonatal mortality was found between the illiterate group and those with primary education. This suggests that it is only the highest levels of education that have a positive effect in reducing the risks of mortality in the neonatal period.

Variables indicating the utilisation of maternal health care services accounted for two of the significant relationships in the final model. The number of months pregnant when ante-natal care was sought proved to have a significant positive relationship with the risk of neonatal mortality, with those seeking care in the seventh month of pregnancy 47% more likely to experience neonatal death than those who sought care during the first two months. Those who reported receiving no-antenatal care had a 50% higher risk of neonatal mortality than those seeking ante-natal care during the first trimester of pregnancy. A 61% increase in the risk of neonatal mortality was found among those who did not receive tetanus toxoid injections during pregnancy (OR 1.61), compared to those who had received the necessary two doses. The significance of these variables highlights the importance of pre-natal care in reducing the risks of neonatal mortality through the early detection of abnormalities and the monitoring of foetal growth.

The state in which the respondent lives proved to be significantly related to the risk of neonatal mortality. Using Kerala as the base category, due to its reported low levels of infant mortality (INFHS 1992), 19 of the remaining states had significantly different risks of neonatal mortality. The highest risks were found in the northern states of Uttar Pradesh (OR 4.09), Assam (OR 3.88), Orissa (OR 3.61), Punjab (OR 3.38) and Bihar (OR 3.55). This result suggests the continuation of the north-south divide in the spatial distribution of mortality as suggested by Dyson and Moore (1983). There were no states proving to have significantly lower risks of neonatal mortality than Kerala, confirming the position of Kerala as the lowest mortality state in India.

4.9 Results of Logistic Modelling of Early Post-neonatal Mortality

Table 4.6 displays the results of the logistic modelling of early post-neonatal mortality (1-7 months). Thirteen variables proved to be significantly related to the risk of mortality during this period, and as with neonatal mortality, the model suggests the differing importance of bio-demographic and socio-economic variables. As in the modelling of neonatal mortality, migration failed to provide a significant relationship with the risk of early post-neonatal mortality. This lack of significance may be due to the controlling of differences between the migrant and non-migrant populations through the inclusion of socio-economic variables in the model. Although not significant at the 5% level, the parameter estimates for migration status suggest the emergence of Brockerhoff's (1994) three level relationship between migration and mortality. Relative to rural-urban migrants, rural non-migrants display greater odds of early post-neonatal mortality (OR 1.06), whilst the odds of mortality are lower among the urban non-migrant group (OR0.88)

Table 4.6 Results of Logistic Modelling of Early Post-neonatal Mortality

Variable	N	β	S.E β	Odds Ratio
Migration Variable:				
Migration				
Rural-urban migrant	4205			1.00
Urban non-migrant	5809	-0.121	0.197	0.88
Rural non-migrant	18107	0.066	0.164	1.06
Other migrants	23561	0.171	0.154	1.18
Bio-demographic Variables:				
Birth Interval				
<18 months	4860			1.00
18-36 months **	18530	-0.632	0.111	0.53
36+ months **	13483	-0.961	0.127	0.38
First birth **	14809	-0.650	0.126	0.52
Mothers Age At Birth				
13-19	12763			1.00
20-24**	19564	-0.585	0.257	0.55
25-29**	11836	-0.616	0.269	0.54
30-34**	5124	-0.586	0.285	0.55
35-45	2395	-0.313	0.311	0.73
Multiple Birth				
Single	51120			1.00
Multiple**	562	1.328	0.177	3.77
Sex of Child				
Male	26556			1.00
Female	23126	0.006	0.072	1.00
Ever Breastfed				
Yes	50741			1.00
No **	941	1.638	0.137	5.14
Premature Birth				
No	50451			1.00
Yes**	1060	0.822	0.163	2.27
Don't know	171	0.416	0.525	1.51
Size of Child at Birth				
Large	6800			1.00
Average	35736	0.071	0.123	1.07
Small**	9146	0.697	0.129	2.00

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Variable	N	β	S.E β	Odds Ratio
Survival Status of Previous Child				
Alive	32495			1.00
Dead **	4398	0.224	0.111	1.25
First birth	14809	0.157	0.142	1.16
Consanguineous Marriage				
Not related	44825			1.00
Cousins	4051	0.195	0.141	1.21
Other relatives **	2806	0.331	0.146	1.39
Socio-economic Variables:				
Maternal Education				
Illiterate	31493			1.00
Primary **	16743	-0.209	0.104	0.81
Higher+ **	6446	-0.741	0.209	0.47
Household Density				
Very low	2814			1.00
Average**	37137	-0.406	0.161	0.66
High**	10936	-0.663	0.181	0.51
Very high**	765	-0.626	0.346	0.53
Marital Status				
Married	50831			1.00
Separated **	352	1.260	0.261	3.52
Widowed	401	0.318	0.351	1.37
Divorced	98	0.937	0.749	2.55
Standard of Living Index				
Rich	1732			1.00
Upper Middle	7401	0.122	0.354	1.31
Middle	11159	0.210	0.343	1.23
Lower Middle	23587	0.401	0.345	1.49
Poor	7265	0.453	0.354	1.57
Incomplete	538	0.279	0.509	1.32
Health Care Utilisation Variables:				
Received Tetanus Injection During Pregnancy				
Yes	31670			1.00
No**	20012	0.595	0.085	1.81

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Variable	N	β	S.E β	Odds Ratio
Geographic Variables:				
State				
Kerela	2363			1.00
Andhra Pradesh **	2338	1.329	0.429	3.77
Assam **	4502	1.351	0.417	3.86
Bihar **	1451	1.155	0.413	3.17
Goa	2388	0.206	0.545	1.22
Gujarat **	2273	1.449	0.434	4.26
Haryana **	1859	1.595	0.428	4.92
Himachal Pradesh **	1866	1.156	0.445	3.17
Jammu and Kashmir	2858	0.681	0.493	1.97
Karnataka **	2046	0.817	0.434	2.26
Madhya Pradesh **	4719	1.153	0.411	3.17
Maharashtra	2623	0.522	0.459	1.68
Manipur	714	0.028	0.700	1.02
Meghalaya **	896	1.326	0.481	3.76
Mizoram	597	0.098	0.821	1.10
Nagaland	796	-0.269	0.704	0.76
Orissa **	2856	1.658	0.411	5.24
Punjab **	1874	1.580	0.441	4.85
Rajasthan **	3470	1.068	0.417	2.91
Tamil Nadu	2130	0.796	0.459	2.21
West Bengal **	2834	1.137	0.424	3.31
Uttar Pradesh **	9785	1.410	0.399	4.09
New Delhi **	2385	1.705	0.435	5.50
Arunchal Pradesh	800	0.038	0.638	1.03
Tripura **	708	1.559	0.471	4.75
Constant **		-4.707	0.631	

** P < 0.05

Bio-demographic variables accounted for 8 of the 13 variables significantly related to the risk of early post-neonatal mortality. Mothers age at the birth of the child proved to have a similar relationship with post-neonatal mortality as was found in the neonatal period. Those aged 20-24, 25-29, and 30-34 had significantly lower risks of early post-neonatal mortality than those aged under 19 (OR 0.55, 0.54, and 0.55). The older ages groups (over 35) showed no significant difference in their risk of early post-neonatal mortality than those aged under 19. This result emphasises the importance of the biological condition of the mother in producing strong healthy babies (Madise and Diamond 1995), and indicates that the effects of the disadvantages that young and old maternal age may produce for survival are continued into the early post-neonatal period (Nortman 1974).

Short birth intervals and prematurity are significantly related to the risk of early post-neonatal mortality. Those children with a preceding birth interval of 18-36 months had a 47% lower risk of mortality than those with birth intervals of less than 18 months. The risk of mortality decreased even further for those with birth intervals of over 36 months (OR 0.38). First births proved to have lower risks of early Post-neonatal mortality than those with short birth intervals (OR 0.52). Premature births were twice as likely to result in early post-neonatal death than those born at full-term (OR 2.27). However, the difference between full-term babies and those born to mothers who were unaware of the length of gestation found in the neonatal period was not found to be significant in the post-neonatal period. Prenatal care aims to monitor the development of pregnancy, and thus those mothers who are unaware whether their baby is premature may be those who did not receive prenatal care. Hence, this result may be reflecting the impact of not receiving prenatal care on the survival prospects of those in the early post-neonatal group.

Low birth weight, as indicated by the mother's opinion of the size of the child at birth, proved to be significantly related to the risk of early post-neonatal mortality. Small babies were twice as likely to die in the early post-neonatal period than those babies deemed large (OR 2.00), whilst there was no significant difference between average and large babies. Once again, this indicates that the survival disadvantages created by low birth weight, namely susceptibility to infection and biological weakness, (Belsey and Royston 1987) are continued into the early post-neonatal period.

The survival status of the previous child proved to have a significant relationship with the risk of early post-neonatal mortality. Those whose previous child had died showed a 25% increase in their risk of experiencing early post-neonatal mortality relative to those whose last child was still alive (OR 1.25). This relationship may be explained through genetic or nutritional factors. It may be argued that a previous child death may indicate a history of genetic birth defects, hence increasing the risk of mortality for the index child. Alternatively, a previous child death may be an indication of chronic maternal depletion and nutritional deficiency, again decreasing the survival prospects of the index child through low birth weight (Badari et al 1983).

Multiple births were associated with almost four times the risk of early post-neonatal mortality than singletons (OR 3.77). In the neonatal period the relationship produced an odds ratio of 6.15. This apparent decrease in the risks of mortality associated with multiplicity with the age of the child may be a product of child birth complications, common among multiple births, that have a greater impact during the neonatal period. However, the impact of multiple births on mortality in the early post-neonatal period is still sizeable.

The sex of the child was not significant in determining the risk of early post-neonatal mortality. This indicates that the biological advantage held by girls in the neonatal period has diminished by the early post-neonatal period. The proposed sex differentials in mortality, in favour of the male child, (Dyson and Moore 1983: Basu 1990) still does not appear to be in operation.

Breast feeding provides a natural immunity to infection and a valuable source of nutrition to the infant (Savage-King and Burgess 1992). Those not breast fed proved to have five times the odds of early post-neonatal mortality than those who had been breast fed (OR 5.14). This indicates the importance of breast feeding as a protective agent against mortality. However, only 1.7% of the analysis sample reported not breast feeding in the early post-neonatal period, and thus the impact in the general population would be minimal. The failure to breast feed may be due to illness in either the mother or the child, such that the mother is too weak to breast feed her child, or the child is too weak to suckle. Hence, the increased odds of mortality among those not breast fed may be due to an underlying illness rather than the absence of breast feeding.

Consanguineous marriages are associated with an increased risk of infant mortality due to the expression of recessive genes from a common ancestor (Bittles 1997). Those infants who were the product of consanguineous marriages proved to have higher risks of early post-neonatal mortality than those produced by unrelated couples. Marriages between first cousins were not significantly different in their mortality risk relative to unrelated marriages. However, those between other relatives displayed a significantly higher mortality risk than unrelated marriages (OR 1.39). The category of other relatives includes those consanguineous marriages that are not between first cousins (uncle-niece, second cousins, and other combinations). Consanguineous marriages are most prevalent in the southern states of India, and so it would be expected that there may be a significant interaction between State and consanquinity. However, the modelling process failed to find a significant interaction.

Socio-economic and environmental factors accounted for 3 of the 13 variables significantly related to the risk of early post-neonatal mortality. As with neonatal mortality, there exists a negative relationship between household density and the risk of early post-neonatal mortality. Using households with a low density as the reference category, those in average density households displayed a 34% lower risk of early post-neonatal mortality, with a 49% lower risk in the high and 47% lower risk in the very high density households. Both the standard of living index and the source of non-drinking water failed to provide a significant relationship with early post-neonatal mortality, suggesting the relatively small role of environmental factors in determining the risk of mortality in this period.

Maternal education displayed a significant negative correlation with early post-neonatal mortality. Both primary educated women and those with education of higher and above standard had lower risks of early post-neonatal mortality than the illiterate group. Primary education reduces the risk of mortality in this period by 19% relative to the illiterate category, whereas the corresponding decrease for those with higher-plus education is 53%. The effect of primary education on mortality was not significant in the neonatal period, suggesting that it is more effective in influencing those factors that determine early post-neonatal mortality.

Marital status displayed a significant relationship with early post-neonatal mortality. Those mothers that were separated from their partners showed a three-fold increase in their risk of experiencing post-neonatal mortality relative to those who were married at the time of the survey (OR 3.52). However, the majority of the analysis sample are in marital unions (95%), and the percentage classified as separated is only 0.8%. Hence, the importance of this variable in explaining the determinants of early post-neonatal mortality is limited.

State-level differentials are evident in the risk of early post-neonatal mortality. Again using Kerala as the reference category, higher risks of mortality were found in sixteen of the remaining states. The highest risks relative to Kerala were found in Orissa (OR 5.24), Uttar Pradesh (OR 4.09), Tripura (4.75), Punjab (OR 4.85), and Haryana (OR 4.92). No states proved to have significantly lower risks of early post-neonatal mortality than Kerala. These results are in accordance with literature which suggests that a North-South divide exists in the distribution of mortality in India (Dyson and Moore 1983).

Those mothers who had not received tetanus toxoid injections during pregnancy had an 80% increased risk of experiencing early post-neonatal mortality. Other variables relating to the uptake of pre-natal care (received pre-natal care and months pregnant when sought pre-natal care) did not prove to be significantly related to mortality as they were in the neonatal period. This indicates that pre-natal care is more important as a determinant of neonatal mortality, due to its effectiveness in avoiding complications of child birth, the consequences of which would be observed in the neonatal period. However, the receiving of tetanus toxoid may be used as an indicator of a woman's propensity to utilise health services, thus suggesting that the use of health services are an important determinant of mortality in both the neonatal and early post-neonatal periods.

4.10 Results of the Logistic Modelling of Late Post-neonatal and Toddler Mortality

Table 4.7 displays the results of the logistic modelling of late post-neonatal and toddler mortality (8-24 months). Ten variables were significantly related to the risk of mortality in this period, and once again these were unevenly distributed between the bio-demographic and socio-economic categories.

Table 4.7 Results of Logistic Modelling of Late Post-neonatal and Toddler Mortality

Variable	N	β	S.E β	Odds Ratio
Migration Variable:				
Migration				
Rural-urban migrant	2613			1.00
Urban non-migrant	3925	-0.121	0.197	0.88
Rural non-migrant	12322	0.066	0.164	1.06
Other migrants	14371	0.171	0.154	1.18
Bio-demographic Variables:				
Birth Interval				
<18 months	3207			1.00
18-36 months **	12339	-0.454	0.143	0.63
36+ months **	7938	-1.001	0.175	0.36
First birth **	9279	-0.758	0.169	0.46
Multiple Birth				
Single	32920			1.00
Multiple**	311	-0.982	0.423	0.37
Sex of Child				
Male	17123			1.00
Female **	16108	0.300	0.097	1.35
Premature Birth				
No	32503			1.00
Yes**	616	0.778	0.242	2.17
Don't know	112	0.949	0.583	2.58
Size of Child at Birth				
Large	6136			1.00
Average	20118	-0.027	0.150	0.97
Small**	6977	0.394	0.166	1.48
Time of weaning				
0-6 months	4050			1.00
7+ months **	28539	0.675	0.087	1.96
Not breastfed **	624	0.634	0.262	1.89
Socio-economic Variables:				
Maternal Education				
Illiterate	20513			1.00
Primary **	6084	-0.403	0.153	0.66
Higher+ **	6616	-1.303	0.254	0.27

Continued over page

Variable	N	β	S.E β	Odds Ratio
Standard of Living Index				
Rich	1084			1.00
Upper Middle	3073	1.860	1.037	6.42
Middle **	7185	1.620	1.033	5.05
Lower Middle **	15126	1.960	0.034	7.10
Poor	6416	2.036	1.039	7.66
Incomplete	352	1.098	1.228	2.99
Health Care Utilisation Variable:				
Received Tetanus Injection During Pregnancy				
Yes	16844			1.00
No**	10780	0.505	0.113	1.65
Geographic Variable:				
State				
Kerela	2363			1.00
Andhra Pradesh	2338	0.843	0.641	2.32
Assam **	4502	1.263	0.568	3.53
Bihar **	1451	1.676	0.563	5.34
Goa	2388	0.491	0.716	1.63
Gujarat **	2273	1.602	0.583	4.96
Haryana **	1859	1.416	0.600	4.12
Himachal Pradesh	1866	0.343	0.688	1.41
Jammu and Kashmir	2858	0.600	0.717	1.82
Karnataka	2046	0.967	0.586	2.63
Madhya Pradesh **	4719	1.884	0.561	6.58
Maharashtra	2623	1.053	0.590	2.86
Manipur	714	-0.399	0.854	0.67
Meghalaya	896	0.985	0.673	2.67
Mizoram **	597	2.144	0.720	8.53
Nagaland	796	-6.160	7.702	0.21
Orissa	2856	0.794	0.592	2.21
Punjab **	1874	1.253	0.623	3.50
Rajasthan **	3470	1.610	0.564	5.00
Tamil Nadu **	2130	1.461	0.607	4.31
West Bengal **	2834	1.297	0.577	3.66
Uttar Pradesh **	9785	1.630	0.547	5.10
New Delhi **	2385	1.886	0.603	6.59
Arunchal Pradesh	800	0.625	0.679	1.86
Tripura	708	0.797	0.771	2.22
Constant **		-4.707	0.631	

** $P < 0.05$

Migration status did not provide a significant relationship with the risk of late post-neonatal and toddler mortality, a repeat of the situation in the neonatal and early post-neonatal periods. Once again it is postulated that this is a result of controlling for the differences between migrants and non-migrants through the inclusion of socio-economic variables. Although not significant at the 5% level, the parameter estimates for migration status suggest the presence of the same three level relationship between migration and mortality as observed in the early post-neonatal period. Relative to rural-urban migrants, rural non-migrants display a greater odds of late post-neonatal and toddler mortality (OR 1.06), whilst the odds of mortality are lower among urban non-migrants (0.88).

Birth interval, prematurity and the size of the child at birth all proved to have similar relationships with the risk of late post-neonatal and toddler mortality to those that had been seen in the earlier mortality periods. The risk of late post-neonatal and toddler mortality decreased with the length of the birth interval (18-36 months OR 0.63; 36+ months OR 0.36) relative to short birth intervals of less than 18 months. Premature births were associated with a two-fold increase in the risk of mortality relative to full-term babies (OR 2.17), and small babies displayed a 48% increase in the risk of mortality when compared to large babies (OR 1.48). These results suggest that the biological factors associated with pregnancy, and hence the health of the mother, have influences on mortality beyond the neonatal period, and are still important determinants to the age of 24 months.

The timing of weaning proved to be significantly related to the risk of late post-neonatal and toddler mortality. Those who were not breastfed were 89% more at risk of experiencing mortality than those who were weaned before the age of six months. In addition, those who were breastfed exclusively for more than six months displayed a 96% greater risk of mortality than those who were weaned before the age of six months. This illustrates two important facets of the breastfeeding - infant mortality relationship. Breastfeeding provides natural immunity and a valuable source of nutrition in resource poor environments and appropriate supplementation is required, hence greater mortality risk is associated with those not breastfed. However, as a child grows it's nutritional demands increase beyond that provided by breastfeeding, hence exclusive breastfeeding for durations longer than 6 months may increase the risk of malnutrition and consequently mortality.

Female children displayed a 35% increase in their risk of experiencing late post-neonatal and toddler mortality when compared to male children. Jain (1979) notes that sex differentials in infant and child mortality are the product of two factors: the innate biologically superior stamina of the female child, and her cultural status in society. This analysis has shown how biological factors in the neonatal period produced the greatest survival prospects for females. In the late post-neonatal and toddler period, however, it would appear that this pattern has been reversed, such that males now have the greatest chances of survival.

Maternal education once again proved to have a negative relationship with the odds of late post-neonatal and toddler mortality. Those with primary education had a 34% lower risk of mortality compared to the illiterate category, whilst those with levels of education of higher level and over had a 73% decrease in their mortality risk. This pattern reinforces the position of maternal education as a major determinant of mortality at ages between 7 and 24 months.

The standard of living index proved to be significantly related to the risk of late post-neonatal and toddler mortality. Significant differences were found between the rich category and the middle (OR 5.05) and lower middle (OR 7.10) categories. The lower middle category accounts for more than one-quarter of the analysis sample. Therefore, this mortality period witnesses the emergence of environmental and socio-economic correlates of mortality, which were not apparent in earlier mortality periods.

Those mothers who did not receive tetanus toxoid injections during pregnancy showed a 65% increase in their risk of experiencing late post-neonatal and toddler deaths relative to those who had received the required injections (OR 1.65). Other variables related to pre-natal care were not significantly related to the risk of mortality, emphasising their importance as determinants of neonatal mortality rather than mortality in the older age-groups. The continued importance of tetanus toxoid as a determinant of mortality in all age groups demonstrates the high risk that tetanus poses for under-two mortality in India. Alternatively, the uptake of tetanus toxoid injections may be used as a proxy for the general use of pre-natal care or for a mother's propensity to use any health services, including child health services, hence suggesting the importance of such care for survival prospects in the first two years of life.

State-level differences are apparent in the risk of late post-neonatal and toddler mortality. Twelve states had significantly higher risks of mortality than the reference state Kerala. The highest rates were found in New Delhi (OR 6.59), Uttar Pradesh (OR 5.10), Rajasthan (OR 5.00), Gujarat (OR 4.96) and Bihar (OR 5.34). This pattern is similar to that witnessed in both the neonatal and early post-neonatal periods, emphasising the importance of State as a determinant of mortality for those aged under two years, and highlighting the continued demographic disequilibrium that exists in India.

4.11 Significance Tests for Migration

The logistic modelling of mortality found that there were no significant differences between the categories of migrants in their risk of mortality in any of the three periods analysed. This section examines the influence of the migration variable as a whole, analysing the difference that the inclusion of migration has upon the final models produced.

The likelihood ratio test compares the observed values of the response variable to predicted values from models with and without the variable in question (Hosmer and Lemeshow 1989). The likelihood ratio is assumed to follow a chi-square distribution. Table 4.8 shows the results of the likelihood ratio test for migration status in each of the mortality periods analysed. The critical value for significance at the 5% level for a variable with three degrees of freedom is 7.81, and we see from the table that migration status is, therefore, not significant in any of the three mortality periods (neonatal $6.93<7.81$, early post-neonatal $4.50<7.81$, and late post-neonatal and toddler $1.79<7.81$). However, migration status is significant at the 10% level in the neonatal period, with 6.93 greater than the critical value of 6.25.

Table 4.8: Likelihood Ratio Statistics for Migration Status

	Neonatal	Early Post-neonatal	Late Post-neonatal and Toddler
With Migration Status	15226.690	7288.848	3657.112
Without Migration Status	15233.624	7293.353	3658.911
Difference	6.934*	4.505	1.799
Degrees of Freedom	3	3	3

*Significant at 10% level

An alternative to the likelihood ratio test is the Wald test (Wald 1943), obtained by comparing the maximum likelihood estimate of the slope parameter ß to an estimate of its standard error. Hauck and Donner (1977) note that this method has a distinct advantage over the likelihood ratio test in that it requires the fitting of the model only under the alternative hypothesis. The likelihood ratio test requires fitting the model twice in order to produce the two comparable likelihoods. Table 4.9 presents the results of the Wald test for migration status in each of the three mortality periods. It is apparent that, as in the likelihood ratio test, migration is not significant at the 5% level in any of the mortality periods. Migration status is again significant at the 10% level in the neonatal period.

The results of the likelihood ratio test and Wald test are in agreement concerning the significance of migration status as a determinant of mortality. Similarities in the results of these significance tests have been noted in Buse (1982), Hosmer and Lemeshow (1989) and Ryan (1997). These results suggest that migration is more important in determining mortality in the neonatal period than in the post-neonatal and toddler periods. Logistic modelling showed that mortality in the first month of life is largely influenced by bio-demographic factors. Given this, it seems plausible to suggest that there may be some relationship between migration status and the bio-demographic correlates of mortality. The relationship between migration status and the bio-demographic determinants of mortality are examined in Chapter 6.

Table 4.9: Wald Test Statistics for Migration Status

	Wald Statistic	Significance level (P-value)
Neonatal	6.749	0.080*
Early Post-neonatal	4.391	0.222
Late Post-neonatal and Toddler	1.777	0.619

*Significant at 10% level

4.12 Discussion

Literature demonstrates that the determinants of mortality change with the age of the child, with a shift from factors associated with the health status of the mother and the birth environment, to factors indicating the physical and socio-economic status of the household (Rama Rao and Pandey 1994). The results of the logistic regression modelling of mortality are thus in accordance with the literature. It has been demonstrated that neonatal mortality is largely determined by bio-demographic factors, whilst the later mortality periods mark the inclusion of socio-economic correlates. However, bio-demographic variables remained the dominant determinants of mortality in all three periods analysed, indicating that factors associated with the health status of the mother and the characteristics of the pregnancy have consequences for child survival throughout the first two years of life.

Jain (1979) notes that sex differentials in mortality are affected by two factors, namely the innate biologically superior stamina of the female child, and her cultural status in society. It is postulated that in less developed societies, where a lower status is given to female children, that these two factors operate in opposite directions to produce weak sex differentials in mortality. Logistic regression found that survival prospects were greater for female neonates, compared to their male counterparts. However, by the late post-neonatal and toddler period this pattern had reversed, with females experiencing a 35% greater risk of mortality than males. The pattern seen in the neonatal period may be explained by biological factors, literature agrees that female babies have an innate biological strength that favours their survival over male babies (Badari 1983; Jain 1979; Basu 1990). Sex differentials in mortality among children have been attributed to the preferential treatment of the male child in terms of the allocation of resources and health care utilisation (Das Gupta 1990; Dyson and Moore 1983). This process is the product of the cultural traditions of the society, and hence sex differentials in mortality are non-uniform across societies (Badari 1983; Bajkhaif and Mahadeven 1993). In India it is suggested that sex differentials in mortality, that prevail particularly in the Northern states, are a product of differential uptake of health resources (Basu 1990). In a study of mortality in Punjab, Basu (1990) found that the lowest levels of health care utilisation were found among those under the age of three, and that levels were much lower for female children. This apparent sex-bias in the allocation of resources is due to the status of women in the particular society, which is closely related to the kinship structure of the region (Chen et al 1981). It would thus seem plausible to suggest that the sex differential in mortality found in the late post-neonatal and toddler period is a result of the differential allocation of resources between the sexes, which is in a turn a product of the cultural behaviour prevalent in a particular region. It is interesting to note that sex of the child was not a significant determinant of mortality in the early post-neonatal period. This suggests that the factors operating to create sex differentials in mortality in the neonatal and late post-neonatal and toddler periods cancel out in the 1-6 month group, producing equal odds of mortality for males and females.

In each of the mortality periods analysed significant differences were found between the states in their risks of mortality. Dyson and Moore (1983) report a clear dichotomy in Indian demographic behaviour between the northern and southern states, with the north having the poorest indicators of demographic performance (high fertility and mortality). It is hypothesised that state differentials in mortality are a product of the cultural traditions and kinship structures that prevail in each state, which influence health seeking behaviour, and hence mortality (Gandotra, Das and Dey 1982). Sandhya (1991) notes that the level of infant mortality in Indian states is closely related to the level of social development rather than that of economic productivity, arguing that social development increases the populations receptivity of health care interventions. The greatest state differentials in mortality were found in the neonatal period, with 19 states having significantly higher risks of mortality than Kerala. The number of significantly different states declined with the age of the child. The models controlled for differences in socio-economic conditions and health care utilisation between states, and thus these differences cannot be used to explain the state differentials in mortality. This indicates that there are factors operating to create state level differentials in mortality that are not measured in the INFHS (1992). Basu (1990) notes that differentials in infant mortality are created by the differences in child care practices between regions, castes, and linguistic groups. Hence, the state differentials in mortality may reflect the diversity of cultural attitudes towards child care that exist throughout India. In addition, the availability of health care services varies between states (Kanitkar and Archaya 1994). This differential access to health care between states may act to create infant and child mortality differentials.

Variables indicating the utilisation of pre-natal care were significantly related to mortality in all three periods, suggesting the importance of such care in improving the survival status of the child. This is further emphasised by the significant relationship between mortality and factors indicative of the failure to use pre-natal care (low birth weight and prematurity). However, it was the receiving of tetanus toxoid injections which consistently proved to be related to child mortality. Tetanus is a major cause of death among neonates in India, hence it is the actual receiving of the tetanus toxoid injection, rather than the prenatal care, which provides the greatest protection against neonatal mortality. The utilisation of maternal health care in India has been shown to be low. In a study of Andhra Pradesh, Sivarju (1987) reported that only 23% of women interviewed reported using some form of pre-natal care. It is suggested that this under-utilisation is a product of two sets of factors. Firstly, the accessibility and quality of services has been shown to significantly affect their use (Kanitkar and Archarya 1994), with distance to services and waiting time among the prime reasons reported for failure to attend pre-natal care (Kapil et al 1989). Government and semi-government health services provide a free pre-natal care service. However, these services are often chronically short of all but the most common medicines and rarely have the full levels of staff required, hence diminishing the quality of service provided (Khan et al 1989).

The attitude of the population and their knowledge of the benefits of maternal health care provides the second set of factors influencing utilisation. Saksensa and Srivastava (1986) report that the utilisation of pre-natal care is highest among educated groups and those employed in non-agricultural activity, whose life-style exposes them to the availability of services and encourages their uptake. Among rural populations knowledge on the availability and benefits of services is low (Karnatikar and Sinha 1989), and a general sense of apathy prevails towards seeking health services during pregnancy. The effects of ignorance towards the characteristics and state of pregnancy are reflected in the fact that children born to mothers who were unsure of their prematurity status were twice as likely to die in the neonatal period than full-term babies. In the sample population more than 40% did not receive tetanus toxoid injections during pregnancy, and approximately 30% reported receiving no ante-natal care. Given the demonstrated importance of health related variables as determinants of mortality, it would thus seem plausible to suggest that the under-utilisation of maternal health care in India is contributing significantly to the current high levels of infant and child mortality.

Maternal education can act as a catalyst which allows a whole range of economic factors to become effective in reducing mortality, providing the woman with functional autonomy and the ability to seek health care for herself and her family (Kathervine and Walker 1991). In addition, maternal education enhances the prospects for employment outside of the home, thus increasing exposure to the health services in the general environment and increasing household income. It is suggested that income generated by female members of the household is more likely to be utilised for health care (Mencher 1988), providing the resources to translate new knowledge into health behaviour. The importance of maternal education as a determinant of child mortality is reflected in the fact that it remained significantly related to mortality throughout the first two years of life. Empirical studies suggest that low levels of education are a barrier to the use of maternal health care (Goyal 1989), and that those with higher levels of education are less traditional, superstitious and fatalistic in their outlook towards child care (Badari et al 1983). Approximately 50% of the sample population are illiterate, demonstrating the important contribution that an improvement in levels of female education could hold for levels of infant and child mortality in India. Such a finding has important implications for health policy in India. The low levels of female education and the associated under-utilisation of health care act to create an environment of negative child survival prospects. Recent attempts to improve this situation have included the World Bank Maternity Services Package, which provides medicines, training for traditional birth attendants, delivery kits, and the monitoring of auxiliary nurse midwives in some Indian states. However, given that education appears to act as a barrier to the use of these services, it seems plausible to suggest that interventions are needed to improve the cultural and legal status of women through the provision of greater economic and educational opportunities.

The logistic modelling of mortality did not find significant relationships between some variables which literature suggests are important correlates of mortality. Caste has been shown to be related to the risk of infant mortality, with those in the scheduled castes and tribes three times more likely to experience infant mortality than the forward tribes (Prasad 1997). Bajkhaif and Mahadeven (1993) report higher rates of infant survival among Hindus than in Muslims, yet no evidence of differential survival between religious groups was found in this analysis. An explanation for this may by the controlling for differences between castes and religions through the inclusion of variables relating to the socio-economic status of the household.

The focus of this research is the impact of rural-urban migration on child survival, and from the logistic modelling analysis it would appear that migration status is not a significant correlate of under-two mortality. However, both the preliminary and the bivariate analysis displayed significant differences in survival between migrant and non-migrant groups. The failure of migration to provide a significant relationship with mortality in the logistic modelling process may be due to a number of factors. Section 4.4 highlighted the differences that exist in the levels of education, standard of living, and employment status between migrant and non-migrant groups. The results of logistic regression indicate that these factors are important determinants of mortality, and thus any differences in their distribution between migrants and non-migrants is likely to cause differential mortality rates. However, the inclusion of these variables in the model effectively controls for the differences in child mortality between migrants and non-migrants.

The INFHS (1992) data refers only to females, and thus the relationship between migration and mortality may be influenced by factors specific to female migration. In order to recognise this, a variable was created categorising migration into before, after, or at the time of marriage. It seems plausible to suggest that those who migrate at the time of marriage are migrating for the purpose of marriage, and thus have very different motivations to those who migrate after or before marriage. However, this variable proved not to be significant in the modelling of mortality in any of the three periods analysed. Therefore, it appears that the timing of migration in the life-cycle of the mother is not an important determinant of infant and child mortality. This may also suggest that the factors motivating migration are also not determinants of the mortality prospects of migrant children, although this area requires a qualitative approach to fully investigate the motivations behind rural-urban migration in India. The reasons behind the decision to migrate between a rural and an urban area are examined using a qualitative methodology in Chapter 7.

A variable describing whether the child was born before, after, or in the year of migration was included in the modelling process, but proved not to be significantly related to mortality. It was hypothesised that an infant exposed to the mortality environment in the rural area prior to migration may have a greater risk of mortality than an infant born into the urban environment after migration has occurred. The insignificance of this variable may be due to the controlling for socio-economic factors in the modelling process, which may account for mortality differentials between those born before or after migration. Alternatively, this result may suggest that a change in exposure to mortality environments caused by migration has no effect on the mortality prospects of migrant children.

Interactions were included in the modelling process between migration status and other determinants of mortality. These can be seen in appendix 4.3. Given the varying levels of migration across India (see Chapter 3) it was hypothesised that there may be an interaction between migration status and State. However, this interaction term proved not to be significantly related to mortality in any of the three mortality periods. State was also interacted with other determinants of mortality (maternal education, use of ante-natal care) to reflect the socio-economic diversity of India. Again, these interaction terms proved not to be significant. There are two potential explanations for this. The lack of an interaction between migration status and state may be due to the inclusion of socio-economic variables that control for mortality differentials between migrant groups. Secondly, there exists a clear north/south divide in the demography of India (Dyson and Moore 1983), and thus, in order to reflect this, the states may have to be grouped into north and south categories. The present situation of including all 25 states individually may act to mask the general north/south pattern of Indian demography. Chapter 5 presents separate models for the north and south of India in order to investigate the presence of differing determinants of mortality in the two regions.

Migrants and non-migrants display differences in the type and quality of the health services they utilise (Prasad and Somayjula 1992). Literature suggests that large groups of migrants inhabit the economically inferior sectors of the city, and rely upon government health services, which are characterised by low staff levels and long waiting times. Therefore, it may be argued that differential rates of child survival between migrants and non-migrants are influenced by the quality and frequency of their service use. However, the INFHS only contains data on whether services were used, giving no indication of the quality or frequency of use, and thus this area of the migration - mortality relationship cannot be quantified at this stage of the analysis. Interaction terms were included between migrant status and variables indicating the utilisation of pre-natal care, in order to examine the association between migration status and the differential use of health care services. However, none of these interaction terms proved to be significantly related to mortality. Although this suggests that there is no association between migrants use of pre-natal care and infant mortality, the variables used only measure whether or not the service was used. It seems plausible to suggest that the quality of health services used, the sources of health care services, and the frequency of use may have influences on infant survival. The differences in the types and quality of services used between migrant and non-migrant groups is examined using a qualitative approach in Chapter 7.

There are other areas of the migration and mortality relationship that are difficult to quantify through statistical analysis. Brockerhoff (1990; 1994) argues that the extent to which a migrant assimilates into urban society is influenced by the availability of social institutions that allow the cross-flow of information between migrant and non-migrant groups. Chapter 2 discussed the theory of a "culture of poverty" (Lewis 1966) in which alienation, political dependency and apathy among migrant families lead to parental fatalism towards disease outcome. These subjective forces on the behaviour of migrants are difficult to quantify, yet it may be suggested that such elements of the social environment would have an influence on health behaviour. This area of the relationship requires a qualitative approach in order to identify the experiences, beliefs and cultural attitudes that may influence child care and subsequently child survival (see Chapter 7).

The logistic modelling has shown that the determinants of neonatal and early post-neonatal mortality in India are predominantly bio-demographic, and that the survival status of the child is dependent upon the health status of the mother during pregnancy. Late post-neonatal and toddler mortality is also influenced by bio-demographic factors, although socio-economic factors are more important in this age group than at earlier ages. The state level and sex differentials in mortality well documented in demographic literature are once again apparent in this analysis, highlighting the continued dichotomy in demographic behaviour between the northern and southern states. At this stage in the analysis migration has little impact on the survival prospects of children once other factors are controlled for.

Chapter 5

Multi-Level Modelling of Mortality

5.1 Introduction

Chapter 4 examined the relationship between migration status and child survival in India using logistic modelling, and migration status proved not to be significantly related to survival prospects in any of the three age groups examined, after controlling for other correlates of mortality. In this chapter a multi-level modelling strategy is adopted in order to examine whether the significance of migration status as a predictor of under-two mortality changes once the hierarchical nature of the data set is taken into consideration. This chapter begins with a summary of multi-level modelling theory, and a description of the modelling strategy employed in the analysis of the 1992 Indian National Family Health Survey data. The results of the multi-level modelling are presented, with an emphasis on comparing the results obtained from logistic modelling with those obtained from multi-level modelling. This chapter also concentrates on spatial variations in the risk of mortality, examining inter-state differentials and variations at the primary sampling unit level.

5.2 Multi-level Methodology

The ordinary logistic model, as used in Chapter 4, assumes that all observations modelled are independent. However, this fundamental assumption of logistic modelling is violated when the data modelled has a hierarchical structure, such that cases are clustered within units, and are thus not necessarily independent of each other in their risk of the outcome under observation. In the analysis of child survival it is often found that some children under observation share the same mother, such that the cases of siblings are naturally clustered within families, and hence they share the same maternal characteristics and influences. Given this, it may be assumed that the risk of mortality for siblings may be correlated, such that deaths are clustered within families, hence violating the logistic modelling assumption that all cases are independent. This homogeneity in the risk of child death within families has traditionally been attributed to unobservable factors such as parental behaviour, shared environmental conditions, genetic factors or variations in ecological conditions. Curtis (1992) suggests that even when accounting for the observed shared characteristics of siblings, the unmeasured death-clustering effects typically remain. This residual familial component reflects heterogenous excess risk between families, also known as maternal heterogeneity. In the study of demography, the family unit has been the focus for shared risks in mortality. However, children from the same primary sampling unit or district may also share community level influences on mortality (access to health care facilities and environmental conditions). These shared influences on mortality, either at the maternal or community level, are known as unobserved heterogeneity, and it is through the use of a multi-level modelling strategy that we can attempt to estimate the extent to which such unobserved factors may be an influence on the risk of mortality.

The random effects logistic model provides a method of modelling such hierarchically structured data and estimating the degree of unobserved heterogeneity (Curtis 1992). The random effects model generalises the fixed-effects logistic model by assuming that the individual probabilities of death are equal to the fixed-effects model plus a random perturbation on the logit scale due to the unobserved family or community level effects. By including a random component in the model it is possible not only to estimate the degree of unobserved heterogeneity, but also to determine whether families or communities differ in their risk of child death in excess of the known determinants of mortality included in the fixed part of the model. Prevost (1996) suggests that allowing the risks of mortality to be correlated between siblings enables the modelling of the familial or community component of mortality.

The INFHS (1992) collected complete birth histories from each woman, such that many women contribute more than one birth to the sample, hence siblings are naturally clustered within women. Table 5.1 presents the numbers of mothers experiencing between one and five child deaths in each of the mortality periods under observation in the five years prior to the survey. Although a majority of deaths in each age group represent the only experience of death to that mother, there exists a considerable number of cases in which a mother experiences multiple deaths. For example, in the neonatal period 209 mothers reported experiencing two neonatal deaths, accounting for 8% of all neonatal deaths, indicating some element of death clustering in the data set. Given this, mothers will be used as the second level in the analysis, in order to account for the clustering of child deaths within mothers and to estimate the unobserved familial and household influences on mortality.

Table 5.1 Number of dead children per mother in five years prior to survey

	Number of mothers experiencing child death		
Number of dead children	Neonatal	Early post-neonatal	Late post-neonatal and toddler
1	2194	919	835
2	209	30	21
3	21	1	1
4	3	0	0
5	1	0	0
Total deaths	**2692**	**982**	**880**

In addition to this natural clustering of children within mothers, the sampling system of the INFHS imposes the clustering of women both within households and primary sampling units. The household questionnaire collected data from all women present in the household, and thus in cases where there was more than one eligible woman in the household, women are clustered at the household level. However, such cases account for less than 2% of the total sample, and the household is, therefore, not included as a level of analysis. It is intended that as the majority of households contained only one eligible woman, woman level effects can be used to approximate the household level effects. The terms woman level and household level will thus be used interchangeably. In addition, households were clustered within primary sampling units, with twenty households selected per PSU in urban areas and thirty households per PSU in rural areas. To account for this clustering, the PSU is used as the third level in the analysis, in order to estimate unobserved influences on mortality at the cluster level. The labels are not available to allow the identification of the location of the PSUs, however, they are used as the third level in the model in order to measure unobserved influences operating on mortality above the woman/household level.

This analysis will apply a three level random effects logistic regression model: child (level one), woman (level two), and PSU (level three). The random effects model can be written as follows:

$$logit(p_{ijk}) = x'_{ijk}\beta + u_{jk} + v_k$$

Where p_{ijk} is the probability of dying for the ith child in the jth family in the kth cluster, x'_{ijk} is a vector of covariates corresponding to the ith child in the jth family in the kth cluster, β is a vector of unknown parameters, u_{jk} is the random effect at the woman level, and v_k is the random effect at the primary sampling unit level. The distribution of the random effects is assumed to be normal, with mean zero and variance σ_u^2. When σ_u = 0 the models reduces to the ordinary logistic model, indicating that there is no significant correlation in the risk of mortality between siblings. The testing of the null hypothesis σ_u = 0 against the alternative hypothesis $\sigma_u > 0$ will be used to test the significance of random effects terms, using a modified likelihood ratio test. Maller and Zhou (1996) note that the test statistic is, in large samples, approximately distributed as a random variable which is a 50-50 mixture of χ_1^2 and a point mass at zero , rather than as a chi-square random variable. The 95th percentile of the distribution of such a random variable is given by:

$$\frac{1}{2}+\frac{1}{2}\,P(\chi_1^2 \le c_{0.95}) = 0.95$$

Thus $c_{0.95}$ satisfies $P(\chi_1^2 \le c_{0.95}) = 0.9$, and hence from the standard tables of χ_1^2 the 90th percentile for such a distribution equals 2.71. The critical value for the testing of the significance of the random effects terms is thus 2.71, compared to the critical value of 3.84 used when the distribution of the random variable is assumed to be chi-square without the point mass at zero. As σ_u^2 is a variance, σ_u is constrained to be positive, and hence a one-tailed test is used rather than the usual two-tailed test.

To interpret the random effects model, the parameter estimates are exponentiated and interpreted as odds ratios. However, in the random effects model the probability of death for a particular child depends on both the observed covariates associated with that child and the unobserved random family/cluster effect. The odds ratios are therefore family/cluster specific, as they represent the effect on the risk of death of the particular variable within the particular family/cluster. In the random effects model the odds ratios are thus referred to as average odds ratios. A significant random component (u_{ij}, v_k) indicates that there is a significant variation in the risk of death between families or clusters, suggesting unobserved familial or cluster level heterogeneity. Curtis (1992) notes that a significant random effect may represent some of the variation due to unmeasured covariates. It is argued that the random effects model can be used in situations where an important covariate has been omitted, or to allow for the effects of unmeasured covariates that may be important but are unobserved or unmeasurable.

Multi-level models will be fitted using the **Mln** software package (Rasbash et al 1995). **Mln** contains two methods to approximate the maximum likelihood estimates for the parameters, marginal quasi-likelihood (MQL) and penalised quasi-likelihood (PQL). Although computationally quicker than the PQL procedure, Goldstein (1995) notes that the MQL estimation procedure may under-estimate the values of both the fixed and random parameters, especially where n_{ij} is smaller. Griffiths et al (1999) note that both the MQL and PQL estimation procedures can be improved by including the second order terms in the approximation of the likelihood function, and Goldstein (1995) reports that greater model accuracy is achieved if second order terms are included in the model fit. Rashbash (1999) suggests that first order MQL and PQL are computationally more robust than second order models, and that there are some cases in which second order models will fail to converge. In this case, first order MQL and PQL models may be useful for model exploration (Rasbash 1999). In addition, second order PQL models will only converge when the starting values are a first order MQL model for the same model (Rasbash 1999). Given this, the most desirable model would involve a second-order PQL estimation procedure. In this analysis MQL models were fitted first, as these are computationally quicker. The final models achieved through this method then underwent the PQL estimation procedure, with the aim of arriving at final second-order PQL models. However, convergence could not be achieved for second order models, and thus the models presented in this chapter are first order PQL models.

The variables that proved to be significantly related to the risk of mortality in the logistic modelling process were once again used as potential explanatory variables in the multi-level modelling process. The variables were entered in the same order as they had been in the logistic modelling (migration status, bio-demographic, socio-economic, health utilisation, and geographic), to maintain consistency between the two modelling strategies, and to examine whether the inclusion of random parameters could improve upon the explanatory power of the logistic models. However, some variables which the literature suggested were important determinants of mortality had proved to be insignificant in the logistic modelling of mortality. For example, consanguinity, which increases the risk of congenital birth defects, (Bittles 1997), was not a significant variable in the logistic modelling of neonatal mortality. Migration status proved not to be significantly related to mortality in any of the three age groups modelled. Therefore, the multi-level modelling process includes variables that, although not significantly related to mortality in the logistic modelling process, have enough empirical evidence to suggest that they should prove to be predictors of under-two mortality.

Multiple births are associated with a higher risk of mortality relative to singletons, a pattern that emerged in the logistic modelling of neonatal, early post-neonatal, and late post-neonatal and toddler mortality. Gandotra, Das and Dey (1982) suggest that the high mortality associated with multiple births is attributable to the increased chance of complications occurring during childbirth, particularly if the delivery takes place in a non-medical setting. In addition, multiple births may also result in low birth weights due to the increased demands on the mother, a process exacerbated in an environment of poor nutritional intake. Multiple births are obviously clustered within mothers, and represent a case where the risk of mortality is correlated, but is due to the inherent risks of being a multiple birth, rather than any unobserved familial effects. Therefore, in order to ensure that the random effects measure only the degree of heterogeneity, multiple births are excluded from the analysis. As a result 907 births are excluded from the neonatal group, 485 from the early post-neonatal group, and 243 from the late post-neonatal and toddler group.

5.3 State variations in mortality

In the logistic modelling of under-two mortality, the state in which the respondent lived proved to be significantly related to the risk of mortality in each of the age groups analysed. Kerala was used as the reference state, and a strong pattern emerged in which the northern states consistently proved to have the highest risks of mortality. This north - south dichotomy in the risk of child mortality has been highlighted in previous literature (Dyson and Moore 1983), and is discussed in Section 2.2. These state level differentials in mortality remained after controlling for socio-economic and health care utilisation variables, suggesting that there is some element of state-level unmeasured heterogeneity operating to influence the risk of mortality. In order to measure this, state could be used as a fourth level in the model. However, the analysis uses data for all India, and thus the total population of all 25 possible states are included in the data set. Hence, the fourth level of state would not be a random term in the same way that the primary sampling units and households are a sample of the total number of households and PSUs. Indeed, each of the models presented in this chapter were originally fitted with state as a fourth level, however, the level four residuals proved to be non-normally distributed. This fourth level was thus removed from the model.

In order to further examine the state-level variations in mortality, and to investigate the presence of a north - south divide in the risk of under-two mortality, three modelling strategies are adopted. The first enters the state variable into the model in the same way as was used in the logistic modelling process, such that all twenty-five states are entered as fixed effects terms using Kerala as the reference state. The six small north-eastern states (Mizoram, Manipur, Meghalaya, Tripura, Nagaland, and Arunchal Pradesh) proved not to be significantly different to each other in their risk of mortality in any of the three age groups analysed, and are thus now grouped together and labelled as "north-eastern".

Secondly, separate models are fitted for north and south India. The south model uses data from the following states: Kerala, Andhra Pradesh, Maharashtra, Tamil Nadu, Goa, and Karnataka. The north models includes: Uttar Pradesh, Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Madhya Pradesh, Orissa, Punjab, Rajasthan, West Bengal, North-eastern, and New Delhi. The division of these states between north and south was decided through a comparison of the rate of infant mortality and the levels of a number of socio-economic indicators in each state, such that the northern states represent those with the poorest social and demographic indicators. Various north - south scenarios were investigated, moving some of the borderline states between the north and south models. However, this proved to have very little influence on the overall fit of the models and on the variables that proved to be significantly related to mortality. Table 5.2 shows the number of mothers experiencing multiple deaths in north and south India. Again, there is evidence of death clustering in both north and south India, with some women reporting experiencing multiple deaths in the five years prior to the survey.

Table 5.2 Number of dead children per mother in five years prior to survey by North and South India

	Number of mothers experiencing child death					
	North India			South India		
Number of dead children	Neonatal	Early post-neonatal	Late post-neonatal and toddler	Neonatal	Early post-neonatal	Late post-neonatal and toddler
1	1876	779	747	318	106	88
2	178	19	17	31	11	4
3	19	1	1	2	0	0
4	3	0	0	0	0	0
5	0	0	0	1	0	0
Total deaths	**2301**	**820**	**784**	**394**	**128**	**103**

Finally, models are fitted for each mortality period which include a binary north - south variable, using the same division of states as was used in the separate north/south models. In each of these models the north category is used as the reference. These models are intended to provide an estimate of the differential risk of mortality between north and south India, controlling for the other determinants of mortality.

5.4 Results of multi-level modelling

This section presents the results of the multi-level modelling of mortality in the neonatal, early post-neonatal, and late post-neonatal and toddler age groups. The results obtained from multi-level modelling are compared with those from the logistic modelling process, to establish whether the inclusion of random parameters increases the explanatory power of the model or changes the variables which are significantly related to the risk of mortality. The results from the north and south India models are discussed and compared, detailing the differing determinants of under-two mortality in north and south India. The importance of migration status as a determinant of mortality is also discussed, contrasting the results obtained in a logistic and multi-level logistic modelling process.

5.4.1 Multi-level modelling of neonatal mortality

Table 5.3 displays the results of the multi-level logistic modelling of neonatal mortality. The results presented are first order PQL estimates, a second order PQL model was attempted, but failed to converge. In total, 13 variables proved to be significantly related to the risk of neonatal mortality, as was the case in the logistic modelling of neonatal mortality. Once again, the impact of each of the categories of variables (bio-demographic, socio-economic, and health utilisation) on the risk of neonatal mortality varies, such that some categories contribute more variables to the final model than others.

As in the logistic model, migration status proved not to be significantly related to the risk of neonatal mortality, after controlling for other determinants of neonatal mortality. This indicates that even when allowing for variations in mortality risk between families and clusters, migration status is still not a significant determinant of neonatal mortality. The multi-level logistic model includes a range of socio-economic, environmental and health care utilisation variables, which effectively control for the major differences between migrant and non-migrant groups. However, the parameter estimates, although not significant at the 5% level, show differences in the risk of neonatal mortality between migrant groups. Relative to rural-urban migrants, rural non-migrants have a 12% greater odds of neonatal mortality. The difference in the odds of mortality is smaller between the urban non-migrant and rural-urban migrant group, with the urban non-migrants displaying a 9% greater odds of mortality. This indicates that Brockerhoff's (1994) three level relationship between migration and mortality is not in operation in the neonatal mortality group, with the main difference in mortality observed between urban and rural populations.

Table 5.3: Results of multi-level logistic regression modelling of neonatal mortality using first order penalised quasi-likelihood estimation

Variable	N	β	S.E β	Odds Ratio
Migration variables:				
Migration status				
Rural-urban migrant	4929			1.00
Urban	6731	0.094	0.111	1.09
Rural	21359	0.114	0.097	1.12
Other migrant	28111	0.140	0.097	1.15
Bio-demographic:				
Mothers age at birth				
13 - 19	15315			1.00
20 - 24**	23019	-0.160	0.057	0.85
25 - 29	13887	-0.079	0.071	0.93
30 - 34**	6055	0.192	0.087	1.21
35 - 45	2854	0.163	0.111	1.17
Birth Interval				
< 18 months	5825			1.00
18 - 36 months**	21710	-0.741	0.064	0.47
36 + months**	16206	-1.069	0.074	0.34
First birth**	17389	-0.277	0.070	0.75
Sex of child				
Male	31493			1.00
Female**	29637	-0.170	0.042	0.84
Size of child at birth				
Large	9821			1.00
Average**	37742	-0.822	0.054	0.43
Small	13747	-0.062	0.058	0.93
Premature birth				
No	59350			1.00
Yes**	1714	2.115	0.069	8.28
Don't know**	206	0.540	0.267	1.71

Continued over page ** Significant at 5% level

Variable	N	β	S.E β	Odds Ratio
Survival status of previous child				
Alive	38122			1.00
Dead**	5419	0.533	0.063	1.70
First birth	17589	0.112	0.142	1.11
Socio-economic factors:				
Maternal education				
Illiterate	35960			1.00
Primary**	16410	-0.211	0.069	0.80
Higher**	8760	-0.549	0.104	0.57
Household density				
Very low	3356			1.00
Average**	44254	-0.536	0.086	0.58
High**	12823	-0.913	0.100	0.40
Very high**	918	-1.364	0.238	0.25
Standard of Living Index				
Rich	2009			1.00
Upper middle	5390	0.030	0.155	1.03
Middle	13028	0.010	0.143	1.01
Lower middle**	28126	0.344	0.142	1.41
Poor**	11953	0.445	0.148	1.56
Incomplete	624	-0.194	0.329	0.82
Source of non-drinking water				
Other	43538			1.00
Public pipes**	17592	0.151	0.049	1.16
Health care utilisation variables:				
Months pregnant when sought antenatal care				
0-2	5743			1.00
3-4**	10214	-0.254	0.073	1.77
5-6**	8483	-0.174	0.074	1.84
7-9**	5222	-0.265	0.091	1.76
No antenatal care	31468	0.149	0.126	1.50

Continued over page ** Significant at 5% level

Variable	N	β	S.E β	Odds Ratio
Received tetanus injection during pregnancy				
Yes	37376			1.00
No**	23754	0. 153	0.054	1.16
Geographic variables:				
State				
Kerala	2046			1.00
Andhra Pradesh**	2362	1.081	0.221	2.94
Assam**	2338	1.036	0.218	2.81
Bihar**	4502	1.081	0.206	2.94
Goa	1451	0.192	0.272	1.21
Gujarat**	2388	1.076	0.221	2.93
Haryana**	2273	0.773	0.228	2.16
Himachal Pradesh**	1859	0.851	0.234	2.34
Jammu & Kashmir**	1866	0.929	0.237	2.53
Karnataka**	2858	0.783	0.217	2.18
Madhya Pradesh**	4719	0.937	0.205	2.55
Maharashtra**	2623	0.901	0.224	2.46
Orissa**	2856	1.115	0.210	3.04
Punjab**	1874	0.945	0.240	2.57
Rajasthan**	3470	0.704	0.217	2.02
Tamil Nadu**	2130	0.991	0.221	2.69
West Bengal**	2834	1.047	0.212	2.84
Uttar Pradesh**	9785	1.279	0.199	3.59
New Delhi**	2385	1.071	0.229	2.91
North Eastern States	4511	0.298	0.215	1.34
Random parameters				
Level Two: Mother**		0.459	0.097	
Level Three: Primary sampling unit**		0.072	0.032	

** Significant at 5% level

Bio-demographic factors contribute six variables to the final model, compared to seven in the logistic model (multiple births are excluded form the multi-level modelling process). Hence, the random effects model produces the same bio-demographic determinants of neonatal mortality as were found in the logistic model. However, the standard errors change considerably with the introduction of the random parameters, such that the significance of some categories of the bio-demographic variables have changed.

A mother's age at the birth of her child was significantly related to the risk of experiencing neonatal mortality. Using the reference category of mothers aged less than 19 years, those aged between 20-24 displayed significantly lower risks of experiencing neonatal mortality (OR 0.85), whilst those aged 30-34 showed a significantly higher risk of mortality (OR 1.21). However, in the logistic model, only the age group 20-24 was significantly different to the reference category (OR 0.84), although the parameter estimates for the older age groups were in the same direction as those found in the multi-level logistic model. In both models those aged 35+ were not significantly different in their risk of neonatal mortality relative to those aged less than 19 years. The inclusion of the random parameter, therefore, influences the significance of mothers aged 30-34 as a determinant of neonatal mortality. This suggests that there are some unobserved factors effecting the relationship between neonatal mortality and mothers aged 30-34 that are only accounted for by the random parameters in the multi-level logistic model. The risk of multiple births increases with mother's age, and in the logistic model the inclusion of mutliple births controlled for the relationship between mother's age and multiple births. However, multiple births are excluded from the multi-level analysis, and hence the relationship found between neonatal mortality and mothers aged 30-34 at the birth of their child may reflect the increased risk of multiple births at older ages, and the increased mortality risks associated with multiple births.

The logistic model contained a significant interaction between previous birth interval and the survival status of the previous child, an interaction that was not found in the multi-level logistic model. However both the previous birth interval and the survival status of the previous child did prove to be significant determinants of neonatal mortality in the multi-level logistic model. The risk of neonatal mortality declines with the length of the previous birth interval. Birth intervals of 18-36 months and 36+ months displayed significantly lower odds of neonatal mortality than the reference category of less than 18 months (OR 0.47 and 0.34). The use of the survival status of the previous child acts as a measure of the propensity for children from the same mother to die. The multi-level logistic model shows that there is a 70% greater risk of an infant dying in the neonatal period if the previous child had died in the same period. Therefore, the use of this variable acts in a similar way to the inclusion of the familial level random parameter, in that it estimates the risk of death clustering occurring within families. Hence, the inclusion of a family level random component in the multi-level logistic model may act to explain some of the variation in the risk of neonatal mortality that was previously explained by the interaction between birth intervals and the survival status of the previous child in the logistic model. This may account for the lack of a significant interaction between these two variables in the multi-level logistic model.

Female neonates displayed a significantly lower odds of mortality than their male counterparts (OR 0.84) replicating the pattern observed in the logistic model. Prematurity also proved to be significantly related to the risk of neonatal mortality, with premature births more than eight times more likely to result in a neonatal death than full-term births (OR 8.28). In addition, those births for which the mother did not know whether they were premature were 71% more likely to result in a neonatal death relative to full term births. Prenatal care aims to monitor the development of the foetus, and thus those mothers who did not know whether their baby was premature may also be those who did not have their pregnancies monitored by prenatal care. Hence, this result may be reflecting the greater mortality risks among those who did not receive prenatal care.

The size of the child at birth was significantly related to the risk of neonatal mortality, with a U-shaped relationship emerging. Using large babies as the reference category, average sized babies had a lower odds of dying in the neonatal period (OR 0.43), whilst small babies displayed similar odds of dying to large babies (OR 0.93). These relationships replicate those found in the logistic modelling of neonatal mortality. The consistency of these results between the logistic and multi-level logistic models suggest that these factors, which are essentially biological determinants of neonatal mortality, are not influenced by the inclusion of a random component. In turn, this indicates that any unobserved heterogeneity in neonatal mortality may be associated with behavioural and socio-economic determinants, rather than biological factors which it may be expected to have less variation within a population.

Environmental and socio-economic variables contribute four variables to the final multi-level logistic model, compared to three variables in the logistic model: maternal education, the standard of living index, household density and the source of non-drinking water used are all significantly related to neonatal mortality. Maternal education was shown to be significantly related to the risk of experiencing neonatal mortality. Mothers with primary level education displayed a 20% lower risk of neonatal mortality relative to illiterate mothers, whilst those with higher education and above had a 43% lower risk of neonatal mortality. This suggests the presence of a negative relationship between maternal education and neonatal mortality. The logistic model, however, found no significant difference in the risk of neonatal mortality between illiterate mothers and those with primary level education. A strong negative relationship between maternal education and the survival prospects of her children has been noted in many developing societies (Caldwell and McDonald 1982), a pattern that is more apparent in the multi-level logistic model than in the logistic model. The main difference between the two models is the inclusion of the two random parameters in the multi-level logistic model. This suggests that the inclusion of the familial and cluster level random component is influencing the significance of primary level education as a determinant of neonatal education.

The standard of living index was included in the logistic model of neonatal mortality, in order to control for the socio-economic conditions of the household, although it proved not to be significantly related to the risk of neonatal mortality. However, in the multi-level logistic model the standard of living index is significantly related to the risk of mortality. Using the rich group as the reference category, those in the lower middle and poor groups displayed higher risks of neonatal mortality (OR 1.41 and 1.56). Once again, the inclusion of the random parameters influences the significance of a socio-economic determinant of neonatal mortality. This may be due to the inclusion of the cluster level random effect, which is accounting for the presence of unobserved heterogeneity at the cluster level. The odds ratios are specific to families and clusters, and therefore the significance of the standard of living index indicates that there are significant risks of neonatal mortality between families and clusters which may be due to the differing socio-economic conditions between these units. The standard of living index is a composite measure of both the socio-economic and environmental conditions of the household, characteristics which we would expect to vary between both families and clusters.

The multi-level logistic model displays similar relationships between the environmental variables and the risk of neonatal mortality that were shown in the logistic model. Household density displays a negative relationship with neonatal mortality, with those in the most crowded households having the lowest odds of experiencing neonatal mortality (OR 0.25). This result is in opposition to previous studies which have shown that living in a crowded house is a significant risk factor for infant mortality (Timeaus and Lush 1995). The source the household uses for non-drinking water is significantly associated with the risk of neonatal mortality. Those using public water pipes had a 16% greater risk of experiencing neonatal mortality, relative the use of "other sources" (piped into the household, shared pipes).

As in the logistic model of neonatal mortality, two variables indicating the utilisation of health care services during pregnancy were significantly related to the risk of neonatal mortality. Those who did not receive the recommended two tetanus toxoid injections during pregnancy displayed a 16% greater risk of experiencing neonatal mortality relative to those who had received the injections. There exists a significant positive relationship between the risk of neonatal mortality and the timing of antenatal care, with those who receive care in the final trimester 30% more likely to experience neonatal mortality than those who received care in the first two months of pregnancy. In addition, those women who did not receive any antenatal care displayed a 53% greater risk of neonatal mortality than those who received care early in pregnancy. These results illustrate not only the health benefits of receiving antenatal care, but also that the timing of care is a particularly important factor in determining the survival status of the neonate.

The state in which the respondent lived proved to be significantly related to the risk of neonatal mortality. Seventeen states displayed higher odds of neonatal mortality than the reference state Kerala. The highest risks of neonatal mortality were found in Orissa (OR 3.04), Uttar Pradesh (OR 3.59), Bihar (OR 2.94), Andhra Pradesh (OR 2.94), and Assam (OR 2.81), replicating the geographical patterns that were found in the logistic modelling process. The six small north-eastern states and Goa were not significantly different in their risk of neonatal mortality to Kerala, a pattern which was also present in the neonatal logistic model. These state-level variations in mortality exist even after controlling for socio-economic and environmental conditions, indicating that they are not a product of state differentials in socio-economic conditions. Hence, there would appear to be some element of state-level unobserved heterogeneity operating to influence neonatal mortality. Section 5.5 examines the state variations in under-two mortality, exploring the use of different models for north and south India to reflect the socio-cultural diversity of India.

The multi-level logistic model included random components for both the family and the cluster, and both of these proved to be significant at the 5% level. The significance of the family level random effect illustrates that there are mothers in the sample who have an increased propensity to experience neonatal death, even after controlling for a range of socio-economic, health care, and bio-demographic variables. This maternal heterogeneity indicates that there are some unobserved factors operating to influence neonatal mortality that are woman specific. This random effect may represent unmeasurable influences on neonatal mortality or determinants of mortality that were not included in the random effects model, or indeed may be a combination of both the unmeasurable and the omitted. The original logistic model fitted variables representing a range of socio-economic, environmental and health care utilisation characteristics (see Appendix 4.4). However, many of these proved not to be significantly related to the risk of neonatal mortality, and thus the model was limited to the final 15 variables. Hence, it may be argued that the significant family level random effect is not due to any omitted variables, as many of the possible determinants of neonatal mortality were tested in the original logistic modelling process. The Indian National Family Health Survey (1992) does not include any data on household income, and given the wide variations in socio-economic status between household, it seems plausible to suggest that the significant family random effect may be due to the omission of such information. However, it might be expected that the inclusion of the standard of living index would act as a proxy variable for the omitted income data.

Alternatively, the significant family level random effects term may represent maternal and household characteristics that are difficult to measure in a large scale social survey. Prevost (1996) suggests that maternal heterogeneity is attributable to genetic, parental and environmental characteristics which are shared by siblings but are unmeasurable in large scale social surveys such as the Indian National Family Health Survey. Basu (1990) reports that there are numerous religious, ethnic, and caste variations in child care practices within India which result in large mortality differentials. Such differences in parental behaviour are difficult to quantify, yet have obvious implications for the survival prospects of the neonate. The family level random effect may be representing these influences on child mortality that are difficult to measure using a large scale social survey, and require a qualitative approach.

Bio-demographic factors proved to be the largest group of factors that were significantly related to the risk of neonatal mortality. Bhatia (1989) notes that mortality in early infancy is largely determined by biological factors, and as many of the significant fixed effect terms are bio-demographic it seems plausible that the family level random effects term should also represent unmeasurable or omitted biological factors. Such factors may include genetic differences between women which result in some women having a greater risk of experiencing neonatal mortality through congenital birth defects or problems experienced during pregnancy.

The cluster level random effect represents omitted or unmeasurable influences on neonatal mortality that operate at the primary sampling unit level. The Indian National Family Health Survey collected village level data, providing information on facilities available in each village sampled in rural areas. However, no such information was collected at the primary sampling unit, so we must conclude that the significant cluster level random effect represents the omitted information on access to services within clusters, plus some unmeasurable elements such as variations in cultural and religious child care practices between clusters. The multi-level logistic modelling of neonatal mortality showed that maternal education and the utilisation of health care services were significantly related to the risk of mortality. Information on the accessibility of health and education services within each primary sampling unit would aid the explanation of cluster level variations in mortality.

5.4.2 Multi-level Modelling of Early Post-neonatal Mortality

Table 5.4 presents the results of the multi-level logistic modelling of early post-neonatal mortality. The results presented are first order PQL estimates, a second order PQL model was fitted, but failed to converge. Migration status once again proved not to be significantly related to the risk of early post-neonatal mortality, after controlling for other variables. It is suggested that the inclusion of socio-economic and health care utilisation variables acts to control for the major differences between migrant and non-migrant groups. This is explored further in Chapter 6, which examines the factors which prevent migration from acting as a significant determinant of under-two mortality. However, the parameter estimates once again suggest that there are mortality differentials between the migrant groups, although these differences are not significant at the 5% level. Brockerhoff's (1994) three level relationship between migration and mortality appears to be in operation in the early post-neonatal period. Rural non-migrants have greater odds of experiencing early post-neonatal mortality (OR 1.77) than rural-urban migrants, whilst the odds of mortality is lower among urban non-migrants (OR 0.95).

Table 5.4: Results of multi-level logistic regression modelling of early post-neonatal mortality using first order penalised quasi-likelihood estimation

Variable	N	β	S.E β	Odds Ratio
Migration variables:				
Migration status				
Rural-urban migrant	4156			1.00
Urban	5712	-0.046	0.176	0.95
Rural	17195	0.056	0.148	1.77
Other migrant	23336	0.060	0.139	1.06
Bio-demographic:				
Mothers age at birth				
13 - 19	12660			1.00
20 - 24**	19383	-0.172	0.090	0.84
25 - 29**	11679	-0.286	0.115	0.75
30 - 34**	5025	-0.276	0.147	0.75
35 - 45	2372	0.144	0.165	1.15
Birth Interval				
< 18 months	4643			1.00
18 - 36 months**	18442	-0.765	0.097	0.46
36 + months**	13385	-1.135	0.115	0.32
First birth**	14649	-0.773	0.112	0.46
Sex of child				
Male	26275			1.00
Female	24844	-0.006	0.067	0.99
Size of child at birth				
Large	6448			1.00
Average**	35525	-0.462	0.085	0.63
Small	8046	0.229	0.094	1.25
Premature birth				
No	49888			1.00
Yes**	1060	0.845	0.163	2.33
Don't know	171	0.241	0.430	1.27

Continued over page ** Significant at 5% level

Variable	N	β	S.E β	Odds Ratio
Survival status of previous child				
Alive	32212			1.00
Dead**	4252	0.276	0.101	1.31
First birth	14529	0.156	0.132	0.16
Ever Breastfed				
Yes	50241			1.00
No**	845	1.621	0.135	5.06
Socio-economic factors:				
Maternal education				
Illiterate	31210			1.00
Primary**	13550	-0.318	0.096	0.72
Higher**	6359	-0.871	0.194	0.41
Household density				
Very low	2781			1.00
Average**	36730	-0.364	0.152	0.69
High**	10822	-0.605	0.169	0.54
Very high	757	-0.583	0.322	0.32
Standard of Living Index				
Rich	1686			1.00
Upper middle	7401	0.229	0.297	1.25
Middle	11032	0.316	0.275	1.37
Lower middle	23362	0.577	0.272	1.78
Poor**	7265	0.671	0.280	1.95
Incomplete	534	0.279	0.509	1.32
Marital Status				
Married	50291			1.00
Separated**	342	1.140	0.255	3.12
Widowed / divorced	486	0.324	0.299	1.38
Health care utilisation variables:				
Received tetanus injection during pregnancy				
Yes	31170			1.00
No**	19949	0.378	0.103	1.46

Continued over page

** Significant at 5% level

Variable	N	β	S.E β	Odds Ratio
Geographic variables:				
State				
Kerala				1.00
Andhra Pradesh	1781	0.891	0.356	2.44
Assam**	1986	0.838	0.351	2.31
Bihar**	1939	0.963	0.334	2.62
Goa	3701	0.140	0.458	1.15
Gujarat**	1256	1.007	0.358	2.73
Haryana**	1984	1.097	0.352	2.99
Himachal Pradesh	1903	0.564	0.386	1.75
Jammu & Kashmir	1583	0.159	0.428	1.17
Karnataka	1570	0.238	0.369	1.26
Madhya Pradesh**	2400	0.838	0.335	2.31
Maharashtra	3937	0.267	0.384	1.30
Orissa**	2195	1.304	0.335	3.68
Punjab**	1604	1.012	0.373	2.75
Rajasthan**	2901	0.744	0.346	2.10
Tamil Nadu	1819	0.475	0.379	1.60
West Bengal	2391	0.630	0.350	1.88
Uttar Pradesh**	7908	1.008	0.326	2.74
New Delhi**	2031	1.121	0.366	3.06
North Eastern States	3834	0.306	0.343	1.35
Random parameters				
Level Two: Mother		0.229	0.239	
Level Three: Primary sampling unit		0.077	0.071	

** Significant at 5% level

Seven bio-demographic variables proved to be significant determinants of early post-neonatal mortality, compared with nine in the original logistic model. The two bio-demographic variables not in the multi-level logistic model are multiple births, which are excluded for reasons discussed earlier, and consanguinity. In the logistic model consanguinity proved to be a significant factor, with marriage partners who were related displaying a 39% greater risk of early post-neonatal mortality than those who were not related. Curtis et al (1993) report that in the analysis of data in which death clustering occurs, logistic modelling may underestimate standard errors, as the data contains more variability than is allowed for by the model. In the logistic model of early post-neonatal mortality consanguinity was marginally significant, hence the inclusion of random parameters to allow for death clustering has acted to re-estimate the standard errors and has resulted in the variable becoming insignificant.

The seven significant bio-demographic variables in the multi-level logistic model of early post-neonatal mortality replicate the patterns produced in the ordinary logistic model. The mothers age at the birth of her child again displays a U-shaped relationship with the risk of experiencing early post-neonatal mortality. Using mothers aged less than 19 as the reference category, those aged 20-24, 25-29, and 30-34 all displayed lower risks of early post-neonatal mortality. There was no significant difference in the risk of mortality between mothers aged less than 19 and those aged over 35, demonstrating the detrimental effects of childbearing at both young and old ages for the survival prospects of the infant.

Short birth intervals proved to be significantly related to the risk of early post-neonatal mortality. Relative to birth intervals of less than 18 months, birth intervals of 18-36 months and over 36 months displayed lower odds of resulting in early post-neonatal mortality (OR 0.45 and 0.32). This result is consistent with both the original logistic model and previous literature which reports that the presence of short birth intervals in India have acted to maintain high levels of infant mortality (Srivastava 1990).

Those babies that were born prematurely were more than twice as likely to die during the early post-neonatal period (OR 2.33) than full term babies, a result consistent with that found in the logistic model. Once again, there was no significant risk in mortality between full term babies and those born to mothers who did not know if the baby was born prematurely. This is in contrast to the neonatal period, in which not knowing the duration of the pregnancy had been a significant factor in determining mortality. This indicates that maternal ignorance to this aspect of pregnancy has a greater influence on survival prospects in early infancy.

A U-shaped relationship emerged between the size of the child at birth and the risk of early post-neonatal mortality, the lowest risks of mortality are associated with those babies regarded as average sized at birth. Mothers whose previous child had died were 31% more likely to experience early post-neonatal mortality than those whose previous child was still alive at the time of the survey. In addition, breastfeeding proved to be a major determinant of early post-neonatal mortality. Those infants not breastfed have five times the odds of dying in this period (OR 5.06) compared those who had been breastfed, illustrating the nutritional and protective importance of breastfeeding during the first six months of life. The failure to breast feed may the result of illness in the mother or the child, such that the cause of death is not necessarily the lack of breast feeding but the illness that is preventing breast feeding occurring. These three results replicate the same patterns found in the ordinary logistic model.

The sex of the child is not an important determinant of early post-neonatal mortality. The sex differential in mortality found in the neonatal period was attributed to biological differences, which make the male more likely to die during the first week of life. It is postulated that there is a reversal in this survival advantage with age, such that by childhood female children are experiencing higher rates of mortality than males. Chen et al (1981) report that this is due to sex-biased behaviours and practices that discriminate against the female child. However, it appears that this reversal in survival advantages has not evolved by the age of six months.

The multi-level logistic model contains four significant socio-economic variables, compared to three in the ordinary logistic model. The lowest category of the standard of living index becomes significant with the introduction of random parameters, a similar pattern that was witnessed in the neonatal multi-level logistic model. Relative to those in the rich category, the poor category have a 95% greater odds of experiencing early post-neonatal mortality.

Maternal education displays the same relationship with early post-neonatal mortality as was found in the ordinary logistic model. Mothers with primary education are 38% less likely to experience early post-neonatal mortality than illiterate mothers, whilst for mothers with higher education the risk is even lower (OR 0.41). This once again highlights the importance of maternal education as a predictor of mortality in early infancy, and suggests an opportunity to improve infant survival through the adoption of maternal education programs.

There is no significant difference in the risk of early post-neonatal mortality between households with a low density and those with a very high density, forming a U-shaped relationship between mortality and overcrowding. This is in contrast to the strong negative relationship that was found in the logistic model of early post-neonatal mortality. The inclusion of random parameters in the model has allowed for the greater variability in the model due to death clustering, leading to a more accurate estimation of standard errors. This has resulted in the very high category of the household density becoming insignificant, thus producing the more realistic U-shaped relationship rather a linear relationship. It may be argued that those in crowded houses will suffer excess infant mortality due to the increased risk of disease transmission and the potential need to distribute scarce resources across many members of a household. In addition, households with a low density may experience high infant mortality due to a combination of a lack of social support from other adults for the mother, and a lower family total income.

The receiving of tetanus toxoid injections during pregnancy is significantly related to the risk of early-post-neonatal mortality. Those who do not receive the required two doses of tetanus toxoid are 46% more likely to experience mortality than those who do receive the injections. This result is consistent with that found in the logistic model for early post-neonatal mortality.

The state in which the respondent lives proved to be a significant determinant of the risk of early post-neonatal mortality. In the ordinary logistic model 16 states had significantly lower risks of mortality than the reference state Kerala, this has reduced to 10 in the random effects model. Andhra Pradesh, Himachal Pradesh, Karnataka, West Bengal, and the North-eastern states are no longer significantly different to Kerala in their risk of early post-neonatal mortality. This is due to the more accurate standard errors produced by the inclusion of random terms in the multi-level logistic model. Despite controlling for socio-economic indicators, the state level differentials in mortality persist, indicating the presence of some omitted or unmeasurable influences on mortality operating at the state level.

The multi-level logistic early post-neonatal model contained no significant random terms. Both the family and primary sampling unit were included as random terms, but neither produced significant variation in mortality. The presence of unobserved heterogeneity at either the familial or cluster level would indicate the omission of variables that determine the risk of mortality. The lack of significant random terms indicates that the fixed effects are sufficient in explaining early post-neonatal mortality. This does not mean that the transition from logistic to multi-level logistic has not acted to improve our understanding of the determinants of early post-neonatal mortality. The inclusion of random effects terms provided more accurate standard errors, which resulted in some variables becoming insignificant. This indicates that the multi-level logistic model is more robust than the ordinary logistic model.

5.4.3 Multi-level Modelling of Late Post-neonatal and Toddler Mortality

Table 5.5 presents the results of the multi-level logistic modelling of late post-neonatal and toddler mortality. The results presented are first order PQL estimates, a second order model was fitted but failed to converge. In total 8 variables were related to the risk of late post-neonatal and toddler mortality, compared to ten in the ordinary logistic model. Migration status proved not to be a significant determinant of late post-neonatal and toddler mortality after controlling for other factors, replicating the results found in the ordinary logistic model. The parameter estimates for migration, although not significant at the 5% level, once again display evidence of the 3 level relationship between migration and mortality as suggested by Brockerhoff (1994). Relative to rural-urban migrants, rural non-migrants have greater odds of experiencing late post-neonatal and toddler mortality (OR 1.19), whilst the odds of mortality is lower among urban non-migrants (OR 0.93).

Table 5.5 Results of multi-level logistic regression modelling of late post-neonatal and toddler mortality using first order penalised quasi-likelihood estimation

Variable	N	β	S.E β	Odds Ratio
Migration variables:				
Migration status				
Rural-urban migrant	2590			1.00
Urban	3858	-0.067	0.191	0.93
Rural	12207	0.175	0.162	1.19
Other migrant	14264	0.010	0.157	1.01
Bio-demographic:				
Birth Interval				
< 18 months	3207			1.00
18 - 36 months**	12339	-0.643	0.097	0.52
36 + months**	7938	-1.169	0.120	0.31
First birth**	9435	-0.853	0.116	0.42
Sex of child				
Male	16967			1.00
Female**	15952	0.392	0.070	1.38
Size of child at birth				
Large	5842			1.00
Average**	20118	-0.759	0.088	0.46
Small**	6959	-0.297	0.106	0.74
Premature birth				
No	32191			1.00
Yes**	616	0.763	0.197	2.14
Don't know	112	0.471	0.399	1.60
Time of weaning				
0 - 6 months	4000			1.00
7 + months**	28295	0.677	0.088	1.96
Not breastfed**	624	0.637	0.262	1.89

Continued over page ** Significant at 5% level

Variable	N	β	S.E β	Odds Ratio
Socio-economic factors:				
Maternal education				
Illiterate	20219			1.00
Primary**	6084	-0.447	0.114	0.63
Higher**	6616	-1.380	0.197	0.25
Standard of Living Index				
Rich	1062			1.00
Upper middle	3045	0.384	0.393	1.46
Middle	7113	0.484	0.359	1.62
Lower middle**	14997	0.922	0.354	2.51
Poor**	6352	1.067	0.360	2.90
Incomplete	350	1.098	1.278	2.99
Health care utilisation variables:				
Received tetanus injection during pregnancy				
Yes	19397			1.00
No	13540	0.184	0.110	1.20
Geographic variables:				
State				
Kerala	1171			1.00
Andhra Pradesh	1259	0.381	0.465	1.46
Assam**	1312	1.232	0.423	3.42
Bihar**	2347	1.255	0.412	3.50
Goa	818	-0.058	0.599	0.94
Gujarat**	1237	1.401	0.425	4.05
Haryana**	1225	1.321	0.429	3.74
Himachal Pradesh	1036	-0.126	0.547	0.88
Jammu & Kashmir	1015	0.410	0.499	1.50
Karnataka	1560	0.399	0.438	1.49
Madhya Pradesh**	2432	1.328	0.410	3.77
Maharashtra	1453	0.585	0.445	1.79
Orissa**	1521	1.214	0.421	3.36
Punjab**	1014	0.920	0.467	2.51
Rajasthan**	1871	1.252	0.418	3.49
Tamil Nadu	1168	0.751	0.450	2.12
West Bengal**	1536	0.836	0.427	2.30
Uttar Pradesh**	5061	1.365	0.403	3.91
New Delhi**	1323	1.441	0.442	4.22
North Eastern States	2560	0.306	0.343	1.35

** Significant at 5% level

Variable		N	β	S.E β	Odds Ratio
Random parameters					
Level Two:	Mother		0.017	0.214	
Level Three:	Primary sampling unit**		0.214	0.079	

** Significant at 5% level

Six bio-demographic variables displayed significant relationships with the risk of mortality in the ordinary logistic model, this reduced to five in the multi-level logistic model due to the exclusion of multiple births from the analysis. Hence, all bio-demographic variables included in the original logistic model continue to be significantly related to the risk of late post-neonatal and toddler mortality. Previous birth intervals once again display a negative relationship with mortality. Relative to birth intervals of less than 18 months, those with a previous birth interval of 18-36 months had a 48% lower odds of experiencing mortality in the late post-neonatal and toddler period, and the risk of mortality was even lower for those with birth intervals of over 36 months (OR 0.31). This illustrates the impact that short birth intervals have on survival prospects throughout the first two years of life.

Premature births are associated with a two-fold increase in the odds of late post-neonatal and toddler mortality relative to those babies that were born at full term (OR 2.14). There is no significant difference in the risk of mortality between full term babies and those born to mothers who were not aware of the duration of pregnancy. Hence, maternal ignorance to this aspect of pregnancy remains a risk factor restricted to the neonatal period. In the previous two age groups the size of the child at birth had a U-shaped relationship with mortality, with no significant risk in mortality between large and small babies. However, in the late post-neonatal and toddler period a significant difference in the risk of mortality between large and small babies emerges, with small babies 36% less likely to experience mortality.

The timing of weaning proved to be significantly related to the risk of late post-neonatal and toddler mortality, replicating the results of the ordinary logistic model. Those who were not breastfed were 89% more at risk of experiencing mortality than those who were weaned before the age of six months. In addition, those who were breastfed exclusively for more than six months displayed a 96% greater risk of mortality than those who were weaned before the age of six months. This illustrates two important facets of the breastfeeding - infant mortality relationship. Breastfeeding provides natural immunity and a valuable source of nutrition in resource poor environments and appropriate supplementation is required, hence greater mortality risk is associated with those not breastfed. However, as a child grows it's nutritional demands increase beyond that provided by breastfeeding, hence exclusive breastfeeding for durations longer than 6 months may increase the risk of malnutrition and consequently mortality.

The sex of the child proved to be significantly related to the risk of mortality, with females 38% more likely to die in the late post-neonatal and toddler period than their male counterparts. This is in contrast to the neonatal period when sex differentials favoured females. Hence, this period marks the appearance of the reversal in survival advantages which the literature suggests occurs with the age of the child (Chen et al 1981).

The multi-level logistic model contains two significant socio-economic variables, consistent with the results in the ordinary logistic model. Maternal education displays a strong negative association with the risk of late post-neonatal and toddler mortality. Those with primary education have a 37% lower odds of experiencing mortality in this period compared to illiterate women, whilst those with higher education have a 75% decrease in their mortality odds. These results illustrate the impact that a higher level of education has on reducing the risk of mortality relative to those who are illiterate or who have received only primary schooling. The INFHS (1992) shows that only 11% of the sample have attained higher education. Hence, the survival advantage afforded to children of highly educated mothers is in fact limited to a small percentage of the population. This again highlights the need to increase female educational attainment and opportunities as a vehicle for reductions in infant and child mortality.

The standard of living index proved to be significantly related to the risk of late post-neonatal and toddler mortality. Those in the poor and lower middle categories displayed significantly greater odds of mortality than those in the rich category (OR 2.51 and 2.90). The ordinary logistic model found significant differences in the risk of mortality between the lower middle and rich categories, but not between the poor and rich categories. However, the odds ratios in the multi-level logistic model are specific to families within clusters, rather than the individual odds ratios in the ordinary logistic model. Hence, there are significant differences in the risk of mortality between families and clusters due to standards of living, and the greatest risks of mortality are found among those in the poorest sectors of the sample.

The receiving of tetanus toxoid injections during pregnancy proved not to be a significant determinant of late post-neonatal and toddler mortality, in contrast to the result obtained in the ordinary logistic model. It is suggested that the inclusion of random parameters has allowed the estimation of more accurate standard errors. Receiving tetanus toxoid injections during pregnancy was a significant determinant of mortality in the neonatal and early post-neonatal periods. This indicates that the health benefits provided by receiving this form of antenatal care are more influential during early infancy, and that other determinants of mortality have become more important with the increasing age of the child. However, the receiving of tetanus toxoid injections during pregnancy may be an indication of a woman's propensity to use health care, those who receive tetanus toxoid may be considered more likely to utilise health services in general. Thus, the relationship observed between tetanus toxoid and mortality may not be a direct result of the health benefits of the injections, the relationship may be reflecting the lower levels of mortality experienced by those who utilise health services.

The multi-level logistic model displays similar state-level variations in the risk of late post-neonatal and toddler mortality as were seen in the ordinary logistic model. Using Kerala as the reference category, eleven states have significantly higher risks of mortality.

The highest risks of mortality are in the northern states of New Delhi (OR 4.22), Gujarat (OR 4.05) and Haryana (OR 3.74), once again reinforcing the north - south divide in mortality risks, although the six small north-eastern states do not have a significantly different mortality to Kerala. Tamil Nadu had a significantly higher mortality rate to Kerala in the ordinary logistic model, but becomes insignificant when random components are included in the model. It is suggested that this is due to a more accurate estimation of standard errors. These state differentials in mortality exist after controlling for potential socio-economic and environmental differences between the states, suggesting that there are omitted variables that may explain state differentials in mortality, or some factors that cannot be measured in a large scale survey.

The random parameter included for the familial level proved to be insignificant, suggesting that in the late post-neonatal and toddler period there is no variation in mortality between families beyond that described by the fixed effects terms. The variables included as fixed effect terms would thus be sufficient in explaining the determinants of mortality in this period. The familial level random effect is only significant in the neonatal period. Neonatal mortality is commonly associated with bio-demographic factors and health care utilisation, suggesting that maternal heterogeneity may be comprised of variations in these factors, which has a lower impact on mortality at older ages.

The cluster level random effect was significantly related to the risk of late post-neonatal and toddler mortality, indicating the presence of differential mortality between primary sampling units. Child mortality has been shown to be influenced by socio-economic and environmental characteristics, which are modified by individual patterns of behaviour. The significance of this random parameter indicates both the omission of some variables which could potentially explain late post-neonatal and toddler mortality, and the presence of unmeasurable forces on mortality. The Indian National Family Health Survey (1992) documents the utilisation of health care services, but does not include information on the availability of such services. It seems plausible to suggest that differential access to health care services between clusters may act to create variations in mortality, and thus the inclusion of data on health service availability may act to diminish the cluster level unobserved heterogeneity.

Basu (1990) reports that there exist numerous patterns of child care across India which are specific to religious and caste groups. Abu-Loghod (1966) notes that such groups are inherently cohesive, clustering together to form homogenous groups with shared beliefs and practices. Hence, the unobserved cluster level heterogeneity in mortality may be due to differences in child care practices and disease management between clusters. Data on the caste and religious groups within each primary sampling unit would allow this hypothesis to be examined.

5.5 State-level Variations in Under-two Mortality

The results of the logistic and multi-level logistic modelling of under-two mortality displayed state-level variations in mortality in each of the age groups modelled. A clear north - south divide emerged with the northern states consistently showing the largest risks of mortality. This result is consistent with the north-south dichotomy described by Dyson and Moore (1983). In order to further explore the presence of a north - south divide in under-two mortality and to examine the state-level variations in mortality two modelling strategies are adopted. The first uses a north - south binary variable as a fixed effect term in the multi-level logistic modelling of neonatal, early post-neonatal, and late post-neonatal and toddler mortality. All other fixed and random effects terms used in previous models remain unchanged, such that these models act to estimate the degree of north - south differentials in mortality in each of the age groups, controlling for other determinants of mortality and the presence of unobserved heterogeneity. Table 5.6 presents the odds ratios for the north - south binary variable in each of the age groups modelled.

Table 5.6 Comparison of odds of mortality in North and South India

	Odds Ratios for risk of mortality		
	Neonatal	Early post-neonatal	Late post-neonatal and toddler
North India	1.00	1.00	1.00
South India	0.82**	0.63**	0.49**

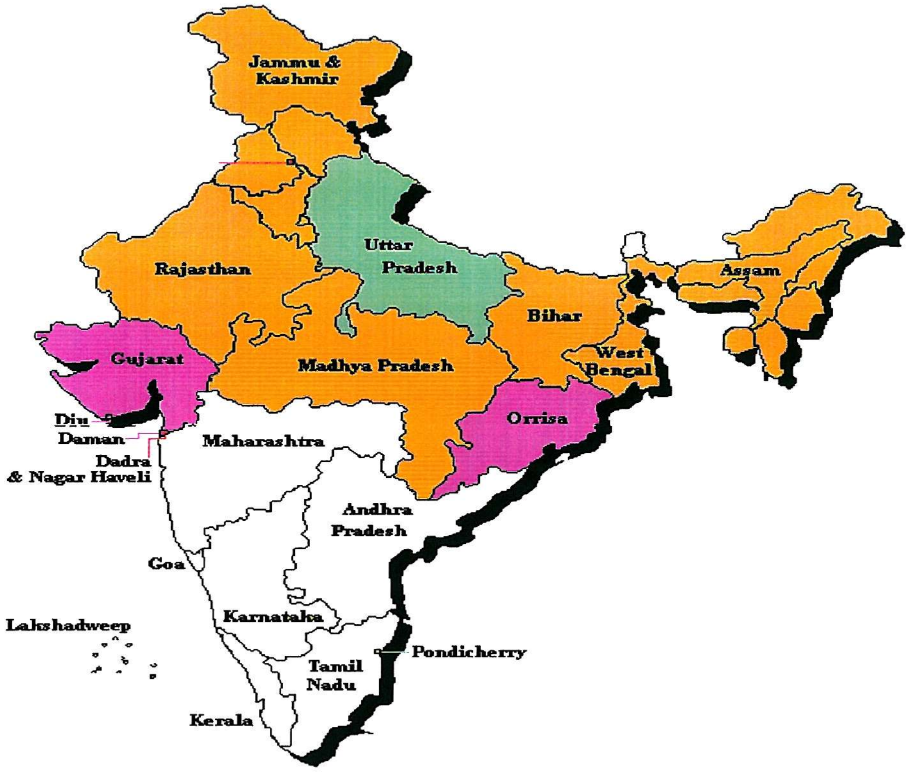
** Significant at 5% level

Table 5.6 shows that in each of the age groups modelled there exists a significant difference in the odds of mortality between north and south India. In the neonatal period those living in the south of India display an 18% lower risk of mortality relative to those in north India, this north - south differential increases to 51% in the late post-neonatal and toddler period. This suggests that after controlling for the socio-economic and environmental characteristics available in the INFHS (1992) there exist other state specific forces on mortality that act to create a clear north - south divide in the risk of under-two mortality. It is important to note that the mortality differential between the north and south increases with the age of the child. Neonatal mortality is largely associated with bio-demographic factors, which it may be suggested are less subject to geographic variation than the socio-economic and environmental determinants of child mortality. However, the north/south differential present in the odds of neonatal mortality may be a product of differences in the availability and quality of obstetric care between the two regions. Karnatikar and Archarya (1994) report that there is a distinct difference in the availability of health services between north and south India, with a greater provision of services in the south. This dichotomy in access to health services may explain the north/south differential observed in neonatal mortality.

Dyson and Moore (1983) suggest that this north-south dichotomy in mortality is due to the variations in the level of female literacy, which influences mortality through the association between increased education and access to health services. In addition, they hypothesised that the presence of differing kinship structures between the north and south creates variations in female autonomy, which in turn influence child mortality. Low levels of female autonomy are associated with limited access to health services and a diminished role in the management of childhood diseases, such that decisions on the utilisation of health care are often made by older members of the household (Bloom et al 1998). As a result, low female autonomy may result in the use of traditional forms of health care, which has obvious connotations for the successful treatment of childhood illnesses.

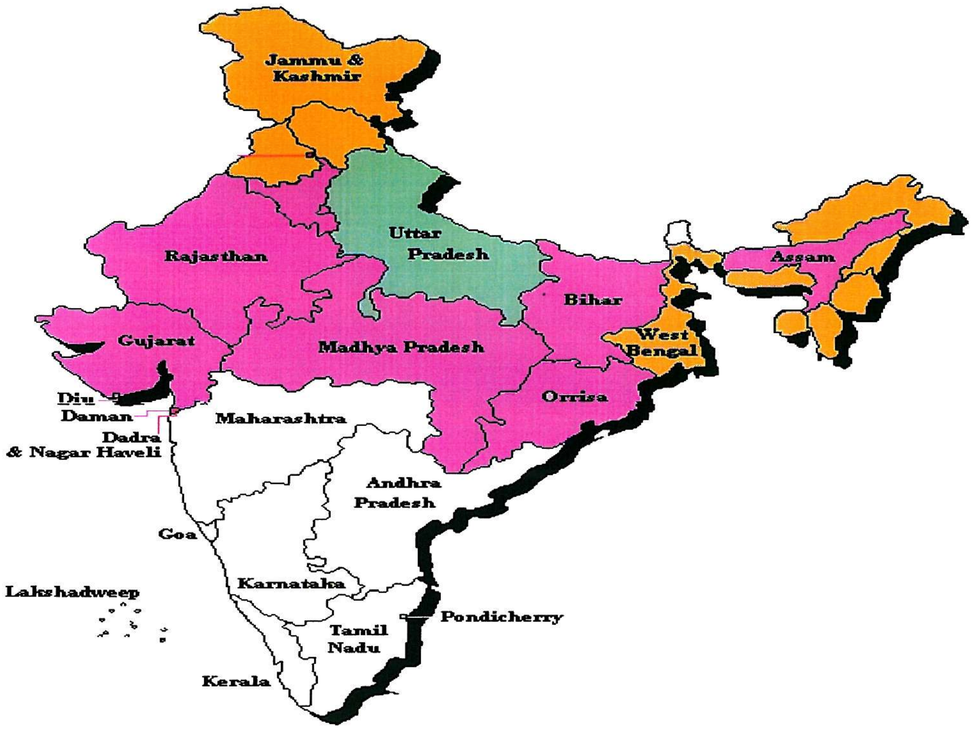
The rates of infant and child mortality vary greatly between the states of India. In addition, indicators such as the level of female illiteracy, which ranges from 75% in Rajasthan to 11% in Mizoram, show that India is socio-economically diverse. Therefore, the use of a north-south binary variable may provide a rather crude representation of the spatial variation of mortality in India. Separate models are fitted for both north and south India, with the aim of examining the spatial variation in mortality within these regions, and to establish whether the determinants of under-two mortality differ between north and south India. For each of the three mortality periods two multi-level logistic models are fitted, one for the northern states and one for the southern states, including the same fixed and random effects terms that were use in the all-India multi-level logistic models. In the north India models Uttar Pradesh was used as the reference state, whilst in south India Kerala was used as the reference state. Figures 5.1 to 5.6 display the state-level variations for neonatal, early post-neonatal and late post-neonatal and toddler mortality in the north and south India models, the odds ratios are presented in Tables 5.7 and 5.8.

Figure 5.1: State variations in neonatal mortality for north India



Reference state | Significantly lower risk | No difference in risk

Figure 5.2: State variations in early post-neonatal mortality for north India



Reference state | Significantly lower risk | No difference in risk

Figure 5.3: State variations in late post-neonatal and toddler mortality in north India

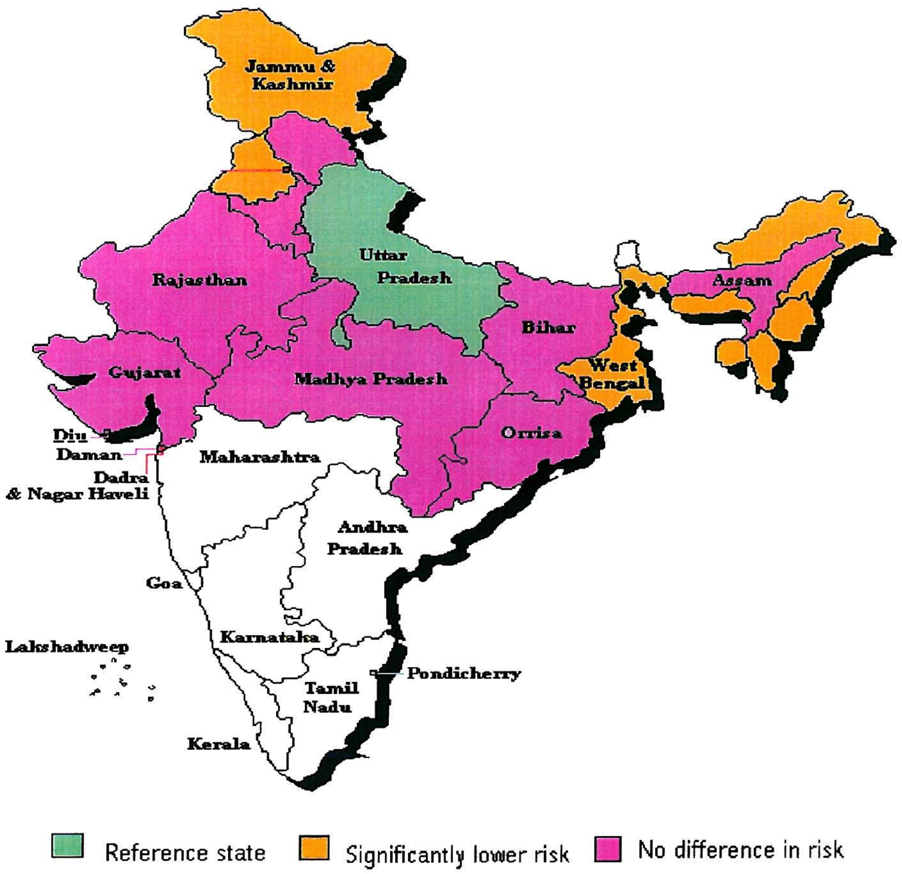


Figure 5.4: State variations in neonatal mortality in south India

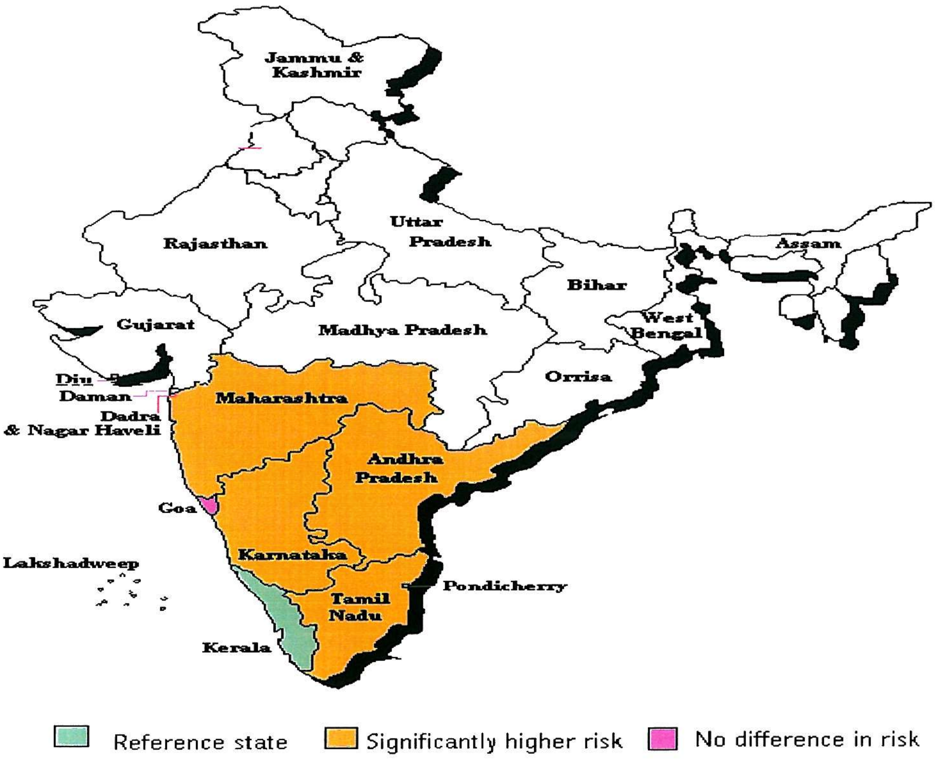


Figure 5.5: State variations in early post-neonatal mortality in south India

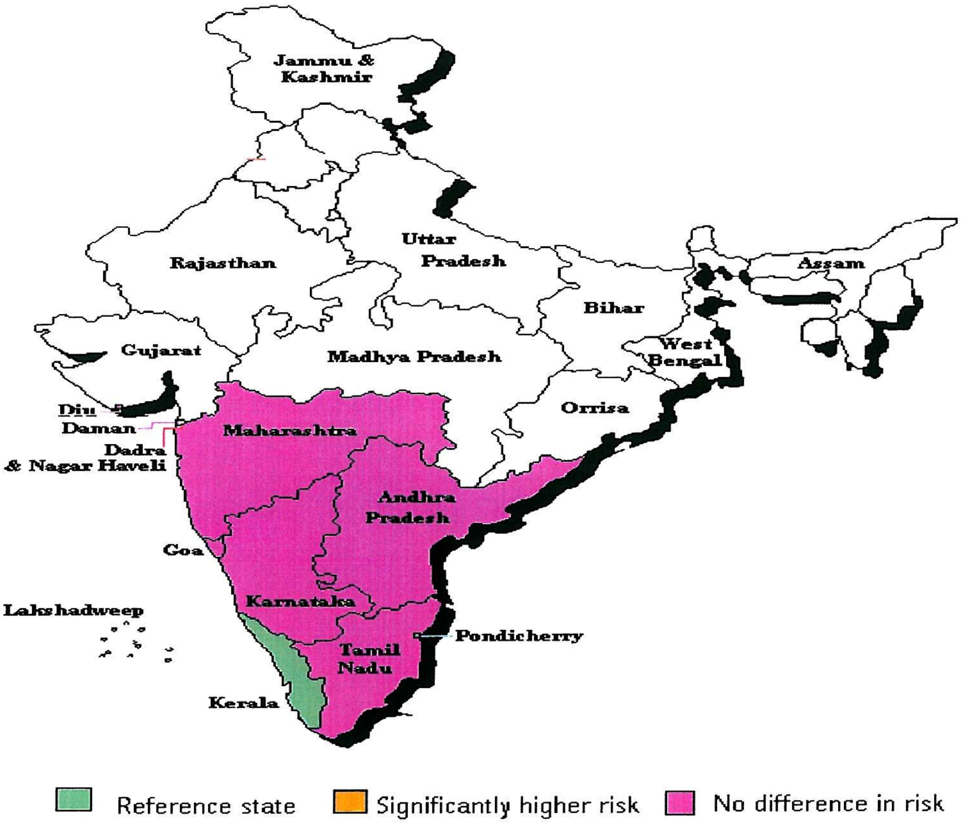


Figure 5.6: State variations in late post-neonatal and toddler mortality in south India

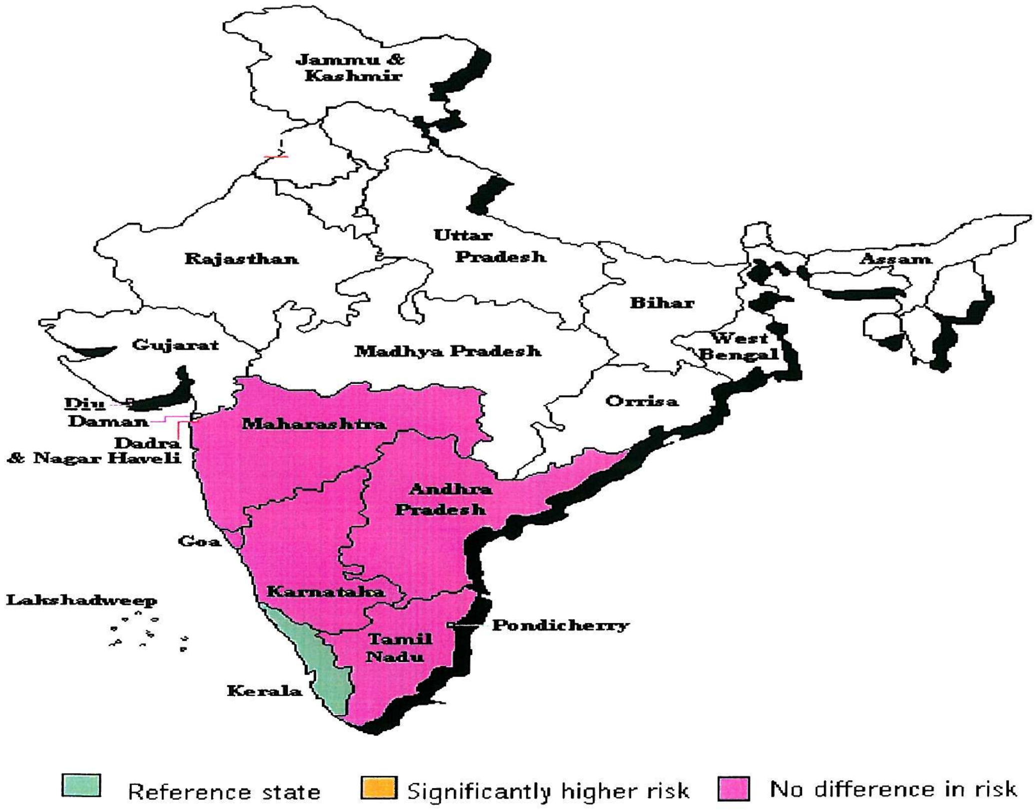


Table 5.7: State-level variation in odds of mortality in North India

	Odds Ratios for risk of mortality		
	Neonatal	Early post-neonatal	Late post-neonatal and toddler
Uttar Pradesh	1.00	1.00	1.00
Assam	0.78**	0.84	0.87
Bihar	0.82**	0.96	0.90
Gujarat	0.81	1.01	1.03
Haryana	0.60**	1.06	0.94
Himachal Pradesh	0.64**	0.63**	0.21**
Jammu & Kashmir	0.69**	0.40**	0.37**
Madhya Pradesh	0.74**	0.86	0.97
North Eastern States	0.37**	0.48**	0.50**
Orissa	0.88	1.31	0.87
Punjab	0.70**	0.98	0.62**
Rajasthan	0.56**	0.77	0.90
West Bengal	0.79**	0.66**	0.58**
New Delhi	0.81**	1.09	1.06

** significant at 5% level

Table 5.8: State-level variation in odds of mortality in South India

	Odds Ratios for risk of mortality		
	Neonatal	Early post-neonatal	Late post-neonatal and toddler
Kerala	1.00	1.00	1.00
Andhra Pradesh	2.49**	1.66	1.14
Maharashtra	2.05**	0.98	1.51
Tamil Nadu	2.42**	1.25	1.73
Goa	1.13	1.10	0.79
Karnataka	1.83**	0.90	1.30

** significant at 5% level

The maps of inter-state variations in mortality in north India display differing patterns with the age of the child. In the neonatal period sixteen states have significantly lower risks of mortality relative to Uttar Pradesh, with only Gujarat and Orissa having similar risks of mortality to the reference state. However, in the early post-neonatal period only nine states have significantly lower risks of mortality relative to Uttar Pradesh, whilst in the late post-neonatal and toddler period ten states display significantly lower risks of mortality. The northern states, therefore, appear homogenous in terms of the risk of early and late post-neonatal and toddler mortality, with only the north eastern states, Jammu and Kashmir and West Bengal displaying significantly lower risks of mortality. However, the neonatal period exhibits a greater degree of heterogeneity, with three states displaying high risks of mortality (Uttar Pradesh, Orissa, and Gujarat). The remaining 16 states show variation in the degree to which the risk of neonatal mortality is significantly lower than that found in Uttar Pradesh. The north-eastern states have a 73% lower odds of neonatal mortality relative to Uttar Pradesh, in comparison the risk of mortality in Bihar is only 18% lower than that in the reference state. This indicates that the factors associated with neonatal mortality are more subject to geographical variation in north India than the determinants of mortality in the later age groups.

A similar pattern is witnessed in south India. In the early post-neonatal and late post-neonatal and toddler periods there is no significant difference in the risk of mortality between any of the states and the reference state Kerala. However, in the neonatal period Andhra Pradesh, Maharashtra, Tamil Nadu, and Karanataka all display higher risks of mortality than Kerala. Again, this indicates that the factors determining neonatal mortality contain a greater degree of spatial variation than those determining mortality beyond the first month of life.

The multi-level logistic models fitted with the inclusion of a north-south binary variable found that the difference in the risk of mortality between north and south India increased with the age of the child. However, the separate north / south models have shown that the greater variation in mortality within north and south India is found in the neonatal period. This suggests that the causes of mortality differentials between the north and south may be largely socio-economic and environmental characteristics, whilst variations in mortality within the north and south regions may be predominantly influenced by bio-demographic and health care utilisation factors.

A clear north-south divide is evident in the distribution of those receiving antenatal care and tetanus toxoid injections, with higher rates of uptake in south India. These factors were shown to be significantly related to mortality in the neonatal and early post-neonatal period. However, within each of the regions there is variability in the distribution of the health care variables. Both north and south India exhibit variations in the uptake of antenatal care. In south India the percentage of those receiving antenatal care ranges from 63.6% in Karnataka to 95.6% in Kerala, whilst in north India there is a range of 23.5% in Rajasthan to 73.7% in Punjab. Hence, the uptake of antenatal care services displays not only a north-south divide, but wide intra-regional variations. This distribution in the uptake of antenatal care may explain the variations in neonatal mortality that were witnessed in both north and south India. However, the utilisation of antenatal care was controlled for in the model. It seems plausible to suggest that the state differentials in mortality are due to variations in factors that are not measured by the INFHS (1992). For example, information on the types of antenatal care used, and the differences in the quality of these services, is not available from the data set. The results of qualitative research in Mumbai, presented in Chapter 7, show that the types and quality of services used differ within a single urban area, hence it might be expected that there would be variations in the availability and quality of care between states, which could offer an explanation for the state differentials in neonatal mortality.

In addition, the percentage of those delivering in a formal health facility and the percentage of births conducted by trained health professionals also exhibit north-south and intra-regional variations. In north India 28% of births are conducted by trained health professionals, with a range of 17% in Uttar Pradesh to 53% in New Delhi. In contrast, 67% of births in south India are conducted by trained health professionals, with a range of 49% in Andhra Pradesh to 89% in Kerala. Gunaskeram (1988) reports that neonatal mortality is 60% higher among home deliveries than those born in medical institutions in India. Again, state level variations in neonatal mortality may be due to factors not recorded in the INFHS (1992). The quality of obstetric care offered may differ between dai, with differences in the levels of experience. Hence, it seems plausible that there may also be differences in the quality of obstetric care between states, creating state level differentials in the odds of neonatal mortality.

A clear differential exists between the two regions in the risk of mortality in each of the age groups analysed, and the south is more homogeneous than the north which displays a greater state variation in the risk of mortality. The multi-level modelling of mortality included a number of socio-economic and health care utilisation variables, hence the socio-economic differences between the states were controlled for. However, mortality differentials were still evident between the states. This suggests that state level differentials in mortality are the product of either factors not recorded in the INFHS (1992) or factors that cannot be recorded in a large scale social survey. Hence, the state differentials in mortality may be due to similar factors which created significant random effects terms in mortality at the all-India level. India is diverse, both socio-economically and culturally, and such diversity may act to create state differentials in mortality Basu (1990) notes that attitudes towards the utilisation of health care and child care practices vary greatly by caste, linguistic group, and region. Therefore, state variations in mortality may be reflecting these wide variations in unmeasured influences on mortality.

5.6 Determinants of Under-two Mortality in North and South India

The previous section has established that a clear north-south differential exists in the risk of under-two mortality, with differential risks of mortality between states in each of these regions. Given this, and the illustrated socio-economic difference between the two regions, it seems plausible to suggest that the determinants of mortality may differ between north and south India. This section presents the results of the separate models that were fitted for north and south India for each of the age groups under analysis. Each model fitted is a three level multi-level logistic model, replicating those fitted for the all-India data set. All variables which proved to be significantly related to mortality in the all-India model are entered into the separate north - south models.

Table 5.9 summarises the results of the separate north - south models. The results of the north India models replicate the results found in the all-India models, with the same variables proving to be significantly related to early post-neonatal and late post-neonatal and toddler mortality. Only in the neonatal period are differences present between the north and all-India models. The size of the child at birth was a significant determinant of neonatal mortality in the all-India model, yet is not related to the risk of neonatal mortality in north India. However, the parameter estimates for the size of the child at birth display a similar relationship to that observed at the all-India level. In north India 18% of babies were reported as having small birth weights, compared to 25% in south India. However, given that north India has displayed a higher rate of neonatal mortality than south India and that birth weight is a significant determinant of mortality, it may be expected that there should be a higher percentage of small babies in north India than in the south. The variable used to measure birth weight is the opinion of the mother on the size of the child at birth, and thus is subjective. Levels of female education are lower in north India with 62% female illiteracy compared to 46% in south India. Therefore, the reporting of the size of the child at birth may be less accurate in the north where female education is lower, resulting in an under-estimation of the proportion of the babies with low birth weights. This may explain the insignificance of the size of the child at birth as a determinant of neonatal mortality in north India.

Migration status proved to be significantly related to the risk of neonatal mortality in north India, with "other migrants" displaying a 30% greater risk of mortality than rural-urban migrants. There was no significant difference in the risk of mortality between rural-urban migrants and those in the rural origin and the urban destination. Rural-rural migrants form over 75% of the "other migrants" category. Gosal and Krishan (1975) report that such migration is precipitated by high unemployment and shortages of fertile land in rural areas, resulting in the out- migration of the rural poor to other rural areas. Hence, this group contains a high proportion of rural socio-economically disadvantaged women. This group is likely to consist of illiterate women with low standards of living, which in a rural environment has obvious implications for neonatal survival. Migrants new to an area face the problem of discovering the location of health services and may suffer from a lack of social networks to provide them with the necessary information.

This is exacerbated by the generally low levels of health service provision in rural areas, which make accessing health services particularly difficult. In contrast, those migrating between rural and urban areas are often the educated and socio-economically advantaged sectors of rural populations, thus this population contains characteristics which predispose them to lower rates of child mortality than are found among the rural poor. In addition, these migrants are moving to urban areas which have a greater availability of health services than is found in rural areas. The differences in resource availability between rural and urban areas may thus influence the differing rates of child survival between rural-urban and rural-rural migrants.

The north model includes data from 19 states, representing 78% of the total Indian sample size, thus explaining the similarities between the north and all-India models. The south models, however, contain only 22% of the all-India sample, and the results presented in Table 5.9 suggest that the determinants of mortality found in south India are different to those observed in the north/all-India models. In the neonatal period the standard of living index and the receiving of tetanus toxoid injections during pregnancy were not significant determinants of mortality. Eighty-seven percent of those in the south receive tetanus toxoid injections during pregnancy, whilst 35% are categorised as having a lower-middle standard of living. This is in contrast to north India, which has lower levels of tetanus toxoid injections uptake (62%), and 48% of its population in the lower categories of the SLI. The almost universal uptake of tetanus toxoid injections in south India thus reduces its importance as a significant determinant of neonatal mortality. Although both regions have high proportions of their populations in the lower categories of the SLI, it may be suggested that the high rates of antenatal care uptake in the south counteract the influence of the standard of living on the risk of neonatal mortality. All other variables that were significantly related to neonatal mortality in the north/all-India models were also related to mortality in the south India model.

Table 5.9: Summarised results of multi-level logistic modelling of under-two mortality in North and South India. All results are first order penalised quasi-likelihood estimates

		Determinants of under-two Mortality														
		Bio-demographic							Socio-Economic					Health Care		Migration
		Mothers age at birth	Birth interval	Sex	Size of child	Breastfed	Survival status of previous child	Premature	Maternal education	SLI	Marital Status	HH Density	Water source	Tetanus toxoid injections	Timing of ANC	Migration status
North India	Neonatal	✔	✔	✔	✗	★	✔	✔	✔	✔	★	✔	✔	✔	✔	✔
	Early Post-neonatal	✔	✔	✗	✔	✔	✔	✔	✔	✔	✔	✔	✗	✔	✗	✗
	Late Post-neonatal and toddler	✔	✔	✔	✔	✔	✗	✔	✔	✔	★	✗	✗	✔	✗	✗
South India	Neonatal	✔	✔	✔	✔	★	✔	✔	✔	✗	★	✔	✔	✗	✔	✗
	Early Post-neonatal	✗	✗	✗	✗	✔	✔	✗	✔	✗	✔	✗	✗	✔	✗	✗
	Late Post-neonatal and toddler	✗	✗	✗	✔	✔	✗	✗	✔	✗	★	✗	✗	✗	✗	✔

✔ = Significant at 5% level ✗ = Not significant at 5% level ★ = Not entered into the model

In the early post-neonatal and late post-neonatal and toddler models for south India only five variables proved to be significantly related to the risk of mortality. Factors which we would expect to be determinants of mortality, such as bio-demographic and health care utilisation variables, were not related to the risk of mortality. Although this analysis has found significant differences in the risk of under-two mortality between north and south India, it must be noted that the rates of mortality observed in south India are still high in relation to those found in developed societies. Thus it would be expected that those factors which literature suggests are determinants of mortality in less developed societies would be in operation in south India.

In south India, in the early post-neonatal period breastfeeding was a significant determinant of mortality, with those not breastfed having four times the odds of dying than those breastfed. Mothers who experienced a previous child death were 65% more likely to experience mortality in this period relative to those whose child was still alive at the time of the survey. Maternal education displayed a strong negative relationship with early post-neonatal mortality, whilst those who were separated from their husbands proved to have a threefold increase in the risk of mortality relative to married women. The receiving of tetanus toxoid injections proved to be a significant determinant of mortality, with those not receiving injections 74% more likely to experience mortality. All other variables entered into the south India model were not significantly related to the risk of early post-neonatal mortality.

In the late post-neonatal and toddler period maternal education, the size of the child at birth and the time of weaning all proved to have similar relationships with mortality to those observed in the all-India model. However, for the first time in this age group, migration status proved to have a significant relationship with mortality. Relative to rural-urban migrants, those who had always lived in urban areas displayed a 56% lower risk of mortality. There was no difference in the risk of mortality between rural-urban migrants and those who remained in rural areas or the "other migrants" category. Hence, it would appear that in south India, migrants who move from a rural to an urban area do not experience a difference in their risk of late post-neonatal and toddler mortality relative to their rural origin. Thus, there are two mortality regimes, the urban and the rural, and migrating from the high to the low regime does not lead to a difference in survival rates among migrant children. This in contrast to the work of Brockerhoff (1994: 1995) which suggests that the survival rates of rural-urban migrants will be between those of the rural origin and urban destination.

The differences observed between the south and all-India models may be due to either genuine differences in the determinants of under-two mortality between north and south India, or the use of a relatively smaller sample size in the south model. The distribution of the risk factors for mortality show a bias towards the north, with a higher concentration of short birth intervals, female illiteracy, low standards of living, and a lower uptake of maternal health services. This is reflected in the higher mortality rates found in northern states. In contrast, the south India sample contains lower percentages of its population in the high risk mortality groups. The failure of many factors to show significant relationships with mortality in south India suggests that there is less variability in the distribution of risk factors between population sub-groups than is observed in north India.

The models for south India used samples with smaller numbers of deaths than used in the all-India and north models. In the early post-neonatal period 128 deaths are modelled, compared to 820 in north India. In the late post-neonatal and toddler period 103 deaths are modelled, compared to 784 in north India. Therefore, the south models are based on smaller number of deaths, due to smaller sample sizes and lower mortality in the southern states. A larger sample size produces smaller standard errors, and thus a greater chance of variables proving significantly related to the outcome. This may explain the difference in the number of variables related to mortality in the north and south models.

In summary, the division of the states into north and south regions has shown that the all-India model is dominated by the high mortality and large sample size of the northern states. With the exception of two variables, all variables which were significant in the all-India model are also significant in the north model. The factors which proved to be related to mortality in the south are also determinants of mortality in north India. The major difference between the two regions is in the number of variables which proved to be related to mortality. It is suggested that this is a product of two factors, the relatively smaller number of deaths modelled in the south which has produced larger standard errors, and a greater variability in the distribution of mortality risk factors in the north.

5.7 Discussion

This chapter extended the analysis presented in Chapter 4 to include a multi-level structure to the modelling process, and has acted to highlight the presence of unobserved heterogeneity in the risk of under-two mortality. The inclusion of random components, and the subsequent increase in the accuracy of standard errors, has changed the significance of some variables. Although the variables included in the models have not changed, the significance of some categories of each variable have been altered. The multi-level logistic models have thus highlighted relationships between mortality and the independent variables that were not observed in the ordinary logistic models, suggesting that the multi-level process has produced more accurate models to explain the determinants of under-two mortality.

The major difference between the ordinary logistic and multi-level logistic models has been the identification of significant random effects terms, which indicates both that there are other determinants of under-two mortality that may have been omitted from the analysis, and that there are influences on mortality that are unmeasurable in a large scale social survey. The model for the early post-neonatal period failed to find significant random effects, indicating that the variables included were adequate in explaining the risks of mortality in this period. In the neonatal period significant random effects were present at both the mother and cluster level. Das Gupta (1990) reports that death clustering in families may reflect differences in biological factors, such as genetically determined frailty, or a tendency for certain mothers to have babies of low birth weights, or to suffer difficult deliveries, or lactational failure. In addition, it is suggested that some families may suffer from an "improvident maternity" syndrome comprised of short birth intervals and/or large families in which higher-parity children receive less parental care and other resources. Das Gupta (1990) also found significant clustering of deaths even after controlling for the biological determinants of mortality, maternal education and socio-economic characteristics of the household, suggesting that death clustering may be due to differences in child care practices which are largely unobservable. However, the Indian National Family Health Survey (1992) does not include some variables which Das Gupta (1990) found to be related to the risk of neonatal mortality, such as lactational failure and protracted deliveries. Hence, the significant random effect in the neonatal period may reflect the omission of such potential determinants of mortality, as well as factors that are unmeasurable in a large scale social survey.

Das Gupta (1990) also reports that mothers experiencing multiple child deaths were often less resourceful and organised in caring for the currently living children and running the household. In addition, such mothers were often unable to describe the circumstances surrounding their child's death, indicating that they had poor perceptions of illness, and may thus be less likely to utilise health services. Therefore, the significant random effect present in the neonatal period may also reflect variances in child care practices and abilities between mothers and households, as Basu (1990) notes that such factors vary greatly across India. Household variations in the use of health facilities may also explain the significant familial level random effect.

The significant random effect in the neonatal period may also represent the whole plethora of cultural influences on mortality that exist within India, and which vary considerably between states. Chapter 2 described how child care practices specific to religious and cultural groups can lead to infant mortality differentials between population sub-groups. In addition, child care practices may differ between households. Griffiths (1998) reports that household power structures can influence the utilisation of health services for both the mother and child, with low female autonomy and service utilisation associated with patriarchal households. In addition, Jejeebhoy (1998) notes that women's experiences of infant and fetal mortality are strongly conditioned by the strength of patriarchy in the highly stratified gender relations association with north India, whilst in south India the more egalitarian power structures promote greater female autonomy.

Significant cluster level random effects were observed in both the neonatal and late post-neonatal and toddler age groups. The Indian National Family Health Survey (1992) collected village level data for rural areas, detailing the presence of health and educational services in each village. However, at the time of analysis this data was not yet available. Data on the presence of services in urban areas was not collected. Sastry (1996) notes that community characteristics may influence child survival by exacerbating or mitigating differentials based on socio-economic attributes, hence complementing or substituting certain household characteristics that may be affecting child survival. Thomas et al (1991) report that in Brazil the presence of health facilities in a community counteracted the low levels of female education. Therefore, the significant cluster level random effects may reflect the omission of service availability data, as it seems plausible to suggest that the presence of health service within an area would have an influence on the levels of infant mortality.

The cluster level random effect was only significant in the neonatal and late post-neonatal and toddler age groups. Thus the random effect is reflecting factors specific to the causes of death in these age groups. The risk of neonatal mortality is related to the receiving of antenatal care and delivery in a formal health facility. In addition, mortality at ages beyond 6 months is associated with the effective treatment of childhood diseases. The presence of health service within an area will thus have influences on mortality in both these periods, determining access to antenatal care and child health facilities. The insignificance of the cluster level random effect in the early post-neonatal period suggests that the determinants of mortality are less influenced by cluster level characteristics than is observed in the other age groups.

The division of the states into north and south highlighted the demographic dichotomy that exists within India, displaying the greater risk of under-two mortality present in north India. The greatest differences in the risk of mortality between north and south are found in the late post-neonatal and toddler period, suggesting that socio-economic variations between the regions have acted to create mortality differentials. However, within the two regions, the greatest variation in mortality exists in the neonatal period. This indicates that India can be divided into two largely homogenous socio-economic regions, yet within these regions the unequal distribution of health services acts to create mortality differentials especially in early infancy. In addition, the cultural variations in child care between states may act to exacerbate the mortality differentials created by health service distribution.

Tables 5.12 to 514 display the odds ratios for the influence of migration status on under-two mortality for each of the four modelling strategies. A comparison of the significance of the odds ratios between the ordinary and multi-level logistic models suggests that the inclusion of the random parameters and the subsequent increase in the accuracy of standard errors did not influence the significance of migration status. In all three mortality periods the odds ratios produced by the ordinary logistic model are similar to those observed in the multi-level logistic model. However, this is not to suggest that the inclusion of random parameters has not increased the explanatory power of the models fitted as significant changes occurred in other fixed effects terms.

The greatest differences in the significance of migration status as a determinant of mortality occurs between the north and south multi-level logistic models. Migration status is significantly related to neonatal mortality in north India and late post-neonatal and toddler mortality in south India. Therefore, by dividing the states into two regions these relationships between mortality and migration which were not apparent in the all-India model have emerged. This indicates that there are different forms of migration-mortality relationships in operation within India which are specific to the cultural and socio-economic settings of the north and south.

Brockerhoff (1994) excluded neonates from analysis as it was suggested that the causes of neonatal death are largely biologically determined, and thus would have no relationship with migration status. However, the north India model shows that although rural-urban migration is not related to neonatal mortality, "other migrants" were 30% more likely to experience neonatal mortality than those who had migrated between rural and urban areas. Over 75% of those in the "other migrant" category are rural-rural migrants, accounting for 35% of the north India sample. Levels of female illiteracy and poverty are high in rural north India, and rural-rural migrants are often the most socio-economically disadvantaged members of rural populations. In addition, the principal reason for migrating between rural areas is for marriage, with women moving to their husband's village upon marriage. Newly married women often hold the lowest status of the female members of the household, and are strongly influenced by the beliefs and attitudes of both their husband and older female members of the household. Therefore, this category of "other migrants" consists largely of young newly married women with potentially low autonomy, exacerbated by the rural environment of poverty and lack of formal health services. Each of these factors has obvious connotations for increasing the prospect of neonatal mortality. In contrast, those migrating between rural and urban areas are generally migrating for economic reasons, and those included in the sample are comprised predominantly of families of migrants rather than single women. Chapter 4 showed that rural-urban migrants have higher levels of educational attainment and standards of living than those remaining in rural areas. Hence, rural-urban migration is selective of those with characteristics that predispose them to lower levels of infant mortality. In addition, rural-urban migrants are migrating to areas with potentially greater availability of health services than was found in their rural origin, whilst rural-rural migrants are moving between similar health care environments.

Table 5.10 Influence of migration status on neonatal mortality in four modelling strategies

	Logistic	Multi-level logistic	Multi-level logistic: North India	Multi-level logistic: South India
Rural-urban migrant	1.00	1.00	1.00	1.00
Urban non-migrant	1.10	1.09	1.22	0.74
Rural non-migrant	1.18	1.12	1.20	0.88
Other migrant	1.27	1.15	1.30*	0.74

* Significant at 5% level

Table 5.11 Influence of migration status on early post-neonatal mortality in four modelling strategies

	Logistic	Multi-level logistic	Multi-level logistic: North India	Multi-level logistic: South India
Rural-urban migrant	1.00	1.00	1.00	1.00
Urban non-migrant	0.88	0.95	0.75	2.61
Rural non-migrant	1.06	1.77	0.96	2.12
Other migrant	1.18	1.06	0.98	1.86

Table 5.12 Influence of migration status on late post-neonatal and toddler mortality in four modelling strategies

	Logistic	Multi-level logistic	Multi-level logistic: North India	Multi-level logistic: South India
Rural-urban migrant	1.00	1.00	1.00	1.00
Urban non-migrant	0.88	0.93	1.07	0.44*
Rural non-migrant	1.06	1.19	1.29	0.74
Other migrant	1.18	1.01	1.10	0.63

* Significant at 5% level

Migration status was significantly related to the risk of late post-neonatal and toddler mortality in south India. Relative to rural-urban migrants, those who had always lived in urban areas were 56% less likely to experience mortality in this age group. Brockerhoff (1994) hypothesises that a three level relationship exists between rural-urban migration and child survival, with the mortality of migrants between that of those in the rural origin and urban destination. However, the south India model suggests that a two level relationship exists, with the low mortality of urban areas and the higher mortality of rural areas. In migrating between the two mortality regimes migrants do not appear to experience a decrease in the levels of infant mortality that they experienced in rural areas.

The socio-economic profile of the rural-urban migrant group indicates that mortality differentials should be present between migrants and those who remain in the rural area. However, there is no significant difference in the risk of mortality between rural-urban migrants and rural non-migrants. Chapter 4 showed that rural-urban migrants have lower standards of living than urban non-migrants. This indicates that in migrating between rural and urban areas migrants are moving into the socio-economically disadvantaged sectors of the city, and as a result lessen the survival advantages that their socio-economic status in rural areas attributed. Brockerhoff (1995) notes that the housing of urban-rural migrants in West Africa is characterised by informal dwellings on the outskirts of the city, lacking in formal health and sanitation facilities. Observations made during the conducting of qualitative research suggest that migrant communities in Mumbai are of a similar quality, with a reliance upon semi-pukka housing and informal sanitation facilities. Hence, rural-urban migrants are moving to communities which have similar environmental hazards for infant mortality as were found in their rural origin.

Urban areas of India have a greater availability of health facilities than rural areas, yet such services are only effective in preventing mortality if they can be accessed by the population in need. Goldscheider (1989) reports that the economic, social and cultural adaption of migrants to the urban environment is an important factor in determining their utilisation of urban services. Migrant populations are inherently cohesive, and migration to an urban area often involves moving to a sector of the city populated by other migrants. Therefore, interaction with the host urban society and the transfer of knowledge regarding service availability may be limited. There is evidence to suggest that formal health facilities were lacking in migrant communities, and that migrants displayed a lack of knowledge on the presence of services in other areas of the city (see Chapter 7).

In summary, this chapter has highlighted several important characteristics of the determinants of under-two mortality in India. Firstly, the Indian National Family Health Survey (1992) cannot provide a full explanation for under-two mortality, the presence of unobserved heterogeneity indicates that there are some determinants of mortality that have been omitted from the analysis. In addition, the significance of the random effects terms also illustrates that there exist forces on mortality that are unmeasurable or unmeasured in a large scale social survey.

The separation of the states into north and south highlighted that a distinct demographic dichotomy exists within India, and that a majority of the population are living in states associated with high rates of infant and child mortality. The determinants of mortality are similar between the north and south, although the distribution of risk factors provides an unfavourable mortality bias towards the north. It is suggested that the state level differentials in mortality are due to regional variations in the unmeasured or unmeasureable influences on mortlaity.

The fixed effects analysis presented in Chapter 4 found that migration status was not a significant determinant of under-two mortality after controlling for other variables, a result replicated in the all-India multi-level logistic model. However, migration status did prove to be related to mortality once the states were separated into north and south. The relationships between mortality and migration were in different age groups and between different migrant groups in the north and south models, indicating that there is no singular migration-mortality relationship that can explain the Indian situation. The differences in socio-economic characteristics between migrant groups and their access to formal health facilities are suggested as the major cause of mortality differentials. The next chapter examines the links between migration status and the other determinants of mortality in order to establish the pathways through which migration status may act to influence under-two mortality.

Chapter 6

Relationships between Migration and the Determinants of Mortality

6.1 Introduction

Mortality rates presented in the preliminary analysis (Section 4.4) showed evidence of differential survival between migrant and non-migrant groups. This result was replicated in the bivariate analysis, which showed migration status to be significantly related (at the 5% level) to mortality in each of the three periods analysed. However, the logistic and multi-level logistic modelling process failed to provide a significant relationship between migration status and mortality at the all-India level after controlling for other socio-economic and health care variables. Given the noted socio-economic differences between the migrant and the non-migrant populations, the inclusion of socio-economic variables in the models acts to control for any mortality differences between migrant and non-migrant groups. This chapter examines the relationship between migration status and the determinants of mortality, in order to establish which of the determinants of mortality act to control for the mortality differences between migrant groups..

6.2 Methodology

Firstly, to determine the gross effects of migration on mortality, logistic models are fitted using migration status as the only independent variable. Those variables that proved to be significantly related to mortality in the logistic modelling process were categorised as: bio-demographic, socio-economic, environmental, health care utilisation, and geographic. Six logistic models are fitted for each of the mortality periods, each model regressing a different category of independent variables together with migration status against mortality. Each of the 6 models are fitted separately, to allow a comparison of the influence of each of the different sets of factors on the relationship between migration and mortality. By comparing the significance of migration status as a determinant of mortality in each of the models to the gross effects it should be possible to establish which of the sets of variables is most influential in altering the significance in the relationship between migration and mortality. The models fitted in each of the three mortality periods are as follows.

Model 1: This measures the gross effects of migration status on mortality, performing a logistic regression between migration status and the survival status of the child.

Model 2: Bio-demographic variables are introduced into the model to measure their impact on the relationship between mortality and migration status. The variables used are: birth interval, mothers age at birth of the child, multiple birth, sex of child, size of child at birth, prematurity, consanguinity, breast feeding, and the survival status of the previous child.

Model 3: A logistic regression model fitting socio-economic variables and migration status against mortality, measuring the extent to which socio-economic factors change the relationship between migration status and mortality. The variables included are: mothers education and the standard of living index.

Model 4: Environmental variables and migration status are regressed against mortality, to examine the influence of environmental factors on the relationship between migration status and mortality. The variables used are: household density and source of non-drinking water.

Model 5: Variables indicating the utilisation of maternal health care are regressed against mortality to examine their influence on the relationship between mortality and migration status. Variables used are: Number of months pregnant when sought ante-natal care and whether or not the mother received tetanus toxoid injections during pregnancy.

Model 6: The state of India in which the respondent lives is used in the model to examine how geographical location may effect the relationship between migration and mortality.

6.3 Rural-urban Migration and the Determinants of Neonatal Mortality

Table 6.1 presents the results of the logistic models fitted to determine the gross effects of migration on neonatal mortality, and the effects that the introduction of each category of dependent variables has on the relationship between migration and mortality. Model one, the gross effects model, displays a significant relationship between migration and neonatal mortality (significant at the 5% level). Rural non-migrants have a 33% greater risk of experiencing neonatal mortality than rural-urban migrants. However, there is no statistically significant difference in the risk of neonatal mortality between the urban non-migrant and rural-urban migrant groups. Chapter 4 showed that the rates of neonatal mortality among these two groups are very similar, at 34.6 per thousand live births in the rural-urban migration group, and 34.1 per thousand live births in the urban non-migrant group (INFHS 1992). Therefore, it would appear that there are two distinct regimes of neonatal mortality, the higher rates found in the rural areas (45.5 per thousand live births), and the lower rates found in the urban area that are apparent in both migrant and non-migrant groups.

Table 6.1: Odds ratios for effects of migration status on neonatal mortality controlling for other correlates of mortality

	Gross effects	Bio-demographic	Socio-economic	Environmental	Health care	State
Rural-urban migrant	1.00	1.00	1.00	1.00	1.00	1.00
Urban non-migrant	0.984	1.011	1.027	1.009	0.980	0.974
Rural non-migrant	1.326**	1.554**	1.068	1.352**	1.072	1.204**
Other migrant	1.369**	1.456**	1.246**	1.363**	1.317**	1.291**

** significant at 5% level

Previous studies have shown that the differences in neonatal mortality rates between urban and rural areas of India may be due to the differential uptake of maternal health care services, which influence the successful outcome of pregnancy (Goyal 1989: Saksena and Srivastava 1986). In rural areas, the cultural norm of home births conducted by untrained dai has potential negative consequences for neonatal survival due to the unhygienic birth environment, and the reliance upon traditional child birth practices. This is in contrast to urban areas, where there is a greater utilisation of antenatal care and formal health services for child birth, hence lowering the risks of mortality to the neonate (INFHS 1992). In addition, the uptake of maternal health care in rural and urban areas is influenced by service availability, the greater prevalence of services in urban areas increases the accessibility of services for the urban population relative to those in rural areas. Hence, one possible explanation for the similarity in neonatal mortality rates between urban non-migrants and rural-urban migrants may be the relatively high levels of maternal health care utilisation by both groups. The INFHS (1992) shows that the uptake of antenatal care services is over 70% among urban non-migrants and rural-urban migrants, compared to less than 40% among rural non-migrants. This suggests that in migrating, rural-urban migrants are moving from an environment in which low levels of health care utilisation are the norm and in which traditional methods of child birth prevail, and are assimilating into the host urban society through the adoption of the urban patterns of maternal health care use.

Alternatively, rural-urban migration may be selective of those with characteristics which predispose them to the utilisation of health care services. Saksena and Srivastava (1986) note that the highest rates of maternal health service usage are found in those educated beyond primary level, and those involved in non-agricultural productivity. Chapter 2 showed that rural-urban migrants have higher levels of education, and consequently higher standards of living (as measured by the standard of living index), than their rural non-migrant counterparts. The socio-economic profile of the rural-urban migrant population, as indicated by standards of living and educational levels, would appear to reflect that of the urban non-migrant population. The presence of such factors associated with the use of maternal health care in both the rural-urban migrant and urban non-migrant populations, may therefore act to explain the similarity between neonatal mortality rates in these two populations.

Model 2 introduces the bio-demographic determinants of mortality into the model, and Table 6.1 shows that this process has no effect in altering the significant relationship between migration and neonatal mortality that was seen in the gross effects model. The risk of neonatal mortality is greater among rural non-migrants than the rural-urban migrant group (OR 1.55), and once again there is no statistically significant difference in the risk of neonatal mortality between rural-urban migrants and urban non-migrants. This result suggests the universal nature of bio-demographic determinants of neonatal mortality, that they are present in all of the populations analysed, and thus have little effect in creating mortality differentials between migrants and non-migrant groups.

The introduction of the socio-economic determinants of mortality in model 3 results in the disappearance of a statistically significant relationship between rural-urban migration and neonatal mortality. The direction of the relationship remains similar to that witnessed in the gross effects model, yet the relationship is no longer significant at the 5% level. This indicates that the relationship between rural-urban migration and neonatal mortality is partly explained by differences in the socio-economic determinants of mortality between migrant and non-migrant groups. Chapter 3 reviewed the relationships between socio-economic status and infant mortality, noting that the level of maternal education and the socio-economic status of the household were important determinants of mortality. The logistic modelling of mortality showed that maternal education is strongly associated with neonatal mortality. Hence, any differences in the distribution of such factors between the migrant and non-migrant populations may act to explain the relationship between migration and neonatal mortality. The rural non-migrant population is characterised by a high level of illiteracy (79%), a concentration in agricultural employment (80%), and low standards of living (55% are classified as having a "lower middle" standard of living index). In contrast, the urban non-migrant population has higher levels of educational attainment, with over 50% achieving education beyond primary level, and has over 60% of its population with standard of living index of "middle" or greater. The rural-urban migrant population has lower levels of illiteracy than are found in the rural non-migrant population, and a similar educational profile to the urban non-migrant population. The major socio-economic difference between rural-urban migrants and urban non-migrants lies in their employment structure. Rural-urban migrants have a higher concentration in the production sector, compared to the relatively higher concentrations of the urban non-migrant population in the service and administrative sectors. The distribution of the socio-economic variables in the migrant and non-migrant populations may explain the presence of neonatal mortality differentials between the groups, particularly the concentration of those factors associated with higher risks of mortality (illiteracy and low standards of living) in the rural non-migrant population, and the relatively higher socio-economic status of those residing in urban areas.

Model 4 shows that the statistically significant relationship between migration and neonatal mortality remains even when controlling for the environmental determinants of mortality. Once again there is no difference in the risk of neonatal mortality between rural-urban migrants and urban non-migrants, yet rural non-migrants display a 35% greater risk of experiencing neonatal mortality than the migrant population. Therefore, the relationship between migration and neonatal mortality would appear to be independent of environmental conditions, suggesting that differences in environmental conditions between migrants and non-migrants can not explain neonatal mortality differentials between these groups. This may be due to the relatively minor role that household environmental conditions have in determining neonatal mortality (Mosley and Chen 1984), with factors associated with health service utilisation during pregnancy more important in determining survival prospects in this period.

Model 5 introduces variables associated with maternal health care utilisation into the model, and there no longer appears to be a significant relationship between rural-urban migration and neonatal mortality. The logistic and multi-level logistic modelling of neonatal mortality showed that variables indicating the utilisation of health services during pregnancy were strongly associated with the risk of experiencing neonatal mortality. Therefore, any differential utilisation of maternal health care between migrant and non-migrant populations may act to partially explain the presence of mortality differentials between these groups. As noted earlier, the INFHS (1992) displays evidence of a greater utilisation of maternal health care services in urban areas than in rural areas, hence the migration between these two environments may lead to an increased uptake of health care services among the migrant population. Indeed, the uptake of maternal health care services among migrants is similar to that found in the urban non-migrant population. The differences in health care utilisation between urban and rural areas may explain the relationship between migration and neonatal mortality: with similar rates of mortality found among urban non-migrants and rural-urban migrants, and the highest rate found in rural areas where health care utilisation is lowest.

Model 6 introduces the state in which the respondent lives into the model in order to examine the effect that differences in demographic characteristics between states has on the relationship between migration and neonatal mortality. Table 6.1 shows that the significant relationship between neonatal mortality and migration remains after the introduction of state into the model, suggesting that the impact of migration on neonatal mortality is independent of the state in which the respondent lives. The pattern of neonatal mortality between migrant groups remains the same, with the major difference found between those living in rural areas and those in urban areas (urban non-migrants and rural-urban migrants). Literature suggests that there is a continued demographic dichotomy in India (Dyson and Moore 1983), with northern states having poorer indicators of demographic performance than their southern counterparts. Hence, it would be expected that the state in which the respondent lives would have an effect on the relationship between neonatal mortality and migration. However, neonatal mortality is largely determined by bio-demographic factors (Mosley and Chen 1984), and thus it seems plausible to suggest that such factors should not differ between geographical location. State may be influential in the migration-mortality relationship at older ages, when the determinants of mortality are more susceptible to geographical variations.

6.4 Rural-urban Migration and the Determinants of Early Post-neonatal mortality

Table 6.2 shows the results of the logistic models fitted to examine the gross effects of migration on early post-neonatal mortality, and the impact that the introduction of each category of variables has on this relationship. Model 1, the gross effects model, shows that there is no statistically significant relationship between rural-urban migration and early post-neonatal mortality, even in the absence of variables controlling for other determinants of mortality. The odds ratios, although not statistically significant, display a similar pattern of mortality as seen in the preliminary analysis (Section 4.4), with urban non-migrants having lower risks of experiencing mortality in this period than rural-urban migrants, and the rural non-migrants having a higher risk of experiencing mortality than both the urban non-migrants and the rural-urban migrants.

Table 6.2: Odds Ratios for Effects of Migration Status on Early Post-neonatal Mortality Controlling for Other Correlates of Mortality

	Gross effects	Bio-demographic	Socio-economic	Environmental	Health care	State
Rural - urban migrant	1.00	1.00	1.00	1.00	1.00	1.00
Urban non-migrant	0.782	0.807	0.810	0.784	0.782	0.794
Rural non-migrant	1.224	1.381**	0.941	1.230	0.979	1.162
Other migrant	1.162	1.262	1.056	1.155	1.118	1.13

** Significant at 5% level

This pattern of early post-neonatal mortality continues with the introduction of each category of mortality determinants, and in all but one of the six models fitted there is no statistically significant relationship between migration and early post-neonatal mortality. In each of the models the determinants of mortality other than migration status are significantly associated with early post-neonatal mortality. Therefore, these results suggest that there is no statistically significant relationship between migration and early post-neonatal mortality, and that the major determinants of mortality in this period are largely socio-economic and bio-demographic, as shown in the modelling of mortality. Table 6.2 shows that the introduction of bio-demographic variables in model 2 results in a statistically significant difference in the risk of early post-neonatal mortality between rural- urban migrants and rural non-migrants, a significance that was not apparent in the gross effects model. Those remaining in the rural area are 38% more likely to experience early post-neonatal mortality than their migratory counterparts. Retherford and Choe (1993) discuss potential reasons why the introduction of a new independent variable into the logistic model may alter the significance of another independent variable. Using the example of a logistic regression with independent variable $X_{1,}$ it is suggested that the introduction of variable X_2 may increase or decrease the significance of X_1 if there is some correlation between X_1 and X_2. Hence, part of the apparent effect of X_1 is actually due to the correlated but omitted independent variable X_2. In the case of model 2, this would suggest that migration status has a true negative effect on early post-neonatal mortality when bio-demographic variables are included into the model, but no significant effect when they are omitted. Hence, indicating some correlation between migration status and the bio-demographic determinants of early post-neonatal mortality.

In order to establish which of the bio-demographic determinants of mortality is correlated with migration status, 9 models were fitted, each regressing a different bio-demographic variable together with migration status against early post-neonatal mortality. The results of these models are presented in Table 6.3.

Table 6.3: Odds ratios for effects of migration status on early post-neonatal mortality, controlling for bio-demographic determinants of mortality

	Rural- urban migrant	Urban non-migrant	Rural non-migrant	Other migrant
Birth interval	1.00	0.801	1.287**	1.158
Mothers age at birth of child	1.00	0.817	1.264	1.129
Multiple birth	1.00	0.763	1.231	1.173
Sex of child	1.00	0.782	1.224	1.162
Size of child at birth	1.00	0.791	1.274	1.214
Prematurity	1.00	0.768	1.285	1.229
Consanguinity	1.00	0.781	1.226	1.163
Ever breastfed	1.00	0.760	1.301	1.256
Survival status of previous child	1.00	0.782	1.179	1.146

** Significant at 5% level

Table 6.3 displays the effects of each of the bio-demographic determinants of mortality on the relationship between migration status and early post-neonatal mortality. It is apparent that in each of the 9 models the odds ratios show the same pattern of mortality. Using rural-urban migrants as the reference category, higher risks of mortality are found among the rural non-migrants, and lower risks among the urban non-migrants. However, only one of the models produces a statistically significant relationship between migration and early post-neonatal mortality. The introduction of birth intervals into the model results in a statistically significant difference in the risk of early post-neonatal mortality between rural - urban migrants and rural non-migrants, with the latter displaying a 29% greater risk of experiencing mortality in this period. Throughout the 9 models there is no statistically significant difference in the risk of early post-neonatal mortality between rural-urban migrants and urban non-migrants. These results suggest that there is some correlation between migration status and birth intervals that is producing a significant relationship between migration and early post-neonatal mortality.

This result may be due to differences in birth intervals between migrant populations. Table 6.4 shows the distribution of birth intervals by migration status. It is apparent that rural-urban migrants have more first births (35.3%) and fewer birth intervals greater than 36 months (21.1%) than non-migrants. Table 4.6 showed that the mortality odds for first births was greater than those for birth intervals greater than 36 months, hence rural-urban migrants should display the highest odds of early post-neonatal mortality. However, it appears that there are some factors that are compensating for this distribution in birth intervals, creating the highest odds of mortality in the rural non-migrant group. Table 5.2 shows that the introduction of the socio-economic and health care variables controls for the relationship between rural-urban migration and early post-neonatal mortality. Thus, differences in access to health care and socio-economic conditions between the rural-urban migrant and rural non-migrant groups may act to compensate for mortality risks afforded by the high percentage of first births in the rural-urban migrant group.

Table 6.4: Percentage distribution of birth intervals by migration status

	Duration of Birth Interval				
	< 18 months	18-36 months	36+ months	First birth	**Total**
Rural - urban migrant	9.9 (415)	33.7 (1419)	21.1 (888)	35.3 (1483)	7.6 (4205)
Urban non-migrant	9.7 (566)	35.3 (2049)	30.7 (1785)	24.3 (1409)	10.6 (5809)
Rural non-migrant	8.9 (1606)	39.9 (7220)	35.5 (6425)	15.8 (2856)	33.1 (18107)
Other migrant	9.6 (2273)	33.3 (7842)	18.6 (7385)	38.5 (9061)	48.5 (26561)
Total	8.7 (4806)	33.8 (18530)	30.1 (16483)	27.0 (14809)	100.00 (54682)

Figures in parenthesis are number of cases

6.5 Rural-urban Migration and the Determinants of Late Post-neonatal and Toddler Mortality

Table 6.5 displays the gross effects of migration status on late post-neonatal and toddler mortality, and the results that the introduction of each of the categories of mortality determinants has on this relationship. Model 1, the gross effects model, displays a statistically significant relationship between migration status and late post-neonatal and toddler mortality. Rural non-migrants have a 50% greater risk of experiencing mortality in this period when compared with rural-urban migrants. The urban non-migrants have a 18% lower risk of experiencing mortality than the rural-urban migrants. Therefore, for the first time since the preliminary analysis in Chapter 4, the three level relationship between migration and mortality as suggested by Brockerhoff (1994:1995) is evident. The risk of experiencing late post-neonatal and toddler mortality for the rural-urban migrant group would thus appear to be between the risks experienced in the rural origin and the urban destination. For the first time there is a significant difference in the risk of mortality between urban non-migrants and rural-urban migrants. This suggests that the differences in the determinants of mortality between these two populations are found among those factors that are influential in late post-neonatal and toddler mortality rather than in the earlier mortality periods.

Table 6.5: Odds ratios for effects of migration status on late post-neonatal mortality controlling for other correlates of mortality

	Gross effects	Bio-demographic	Socio-economic	Environmental	Health care	State
Rural - urban migrant	1.00	1.00	1.00	1.00	1.00	1.00
Urban non-migrant	0.815*	0.922	0.883	0.813	0.797	0.795
Rural non-migrant	1.499**	1.725**	1.007	1.487**	1.083	1.350**
Other migrant	1.132*	1.185	0.965	0.935	0.985	1.077

** Significant at 5% level * Significant at 10% level

Model 2 introduces the bio-demographic determinants of mortality into the model, and the significant difference in the risk of mortality between the urban non-migrants and rural-urban migrants is no longer apparent. However, the difference in the risk of mortality between rural-urban migrants and those remaining in rural areas remains significant. This would suggest that whilst the relationship between migration and mortality among rural-urban migrants and rural non-migrants is independent of bio-demographic factors, such factors appear to be important in explaining the mortality differentials found between rural-urban migrants and urban non-migrants. It would therefore appear that rural non-migrants and rural-urban migrants are similar in their bio-demographic characteristics, and that in migrating the rural-urban migrants are transferring such characteristics to the urban environment, which results in higher mortality relative to the urban non-migrant population. The continued mortality differential between the migrant and rural non-migrant populations indicates that urban living may alter the effect of bio-demographic characteristics on mortality through an increased access to health care services and general standards of living. Hence, an interaction may exist between the effects of bio-demographic characteristics and exposure to health care on mortality in the late post-neonatal and toddler mortality period.

Models 3 and 5 introduce the socio-economic and health care utilisation variables, and in each model there is no longer a significant relationship between migration status and late post-neonatal and toddler mortality. This is a similar pattern as was seen in both the neonatal and early post-neonatal periods, suggesting the continued importance of these factors as determinants of mortality throughout the first two years of life. The differences in both the socio-economic status and patterns of health care utilisation between migrants and non-migrants are important in explaining the presence of mortality differentials between these populations.

Model 4 introduces the variables indicating household environmental conditions into the model, and there is a statistically significant difference in the risk of mortality between rural-urban migrants and rural non-migrants. Those remaining in the rural areas have a 48% greater odds of experiencing late post-neonatal and toddler mortality than their migratory counterparts. This would suggest that mortality differentials between those remaining in rural areas and those migrating to urban areas are independent of the effects of household environmental conditions.

There is no statistically significant difference in the odds of mortality between rural-urban migrants and urban non-migrants, indicating that household environmental conditions may act to explain mortality differences between these two groups. The variables used to represent household conditions were household density and source of non-drinking water, as these proved to be significantly related to mortality in the logistic and multi-level logistic modelling processes. Both of these variables may be used as indicators of exposure to infectious diseases. Living in a crowded house may increase the risk of passing infection between members of the household, and the use of an informal water source may increase the risk of infection due to exposure to potentially contaminated water. Infectious diseases are a major cause of death among those in the late post-neonatal and toddler age group. Given this, it would appear logical that the factors explaining mortality differentials between migrant groups are also those that are related to the risk of developing infectious diseases.

6.6 Inter-relationships Among the Determinants of Mortality

The previous sections showed the impact that each category of variables has on the relationship between migration status and mortality, allowing the identification of those factors that are influential in explaining the impact of migration on mortality. This section examines the inter-relationships between the determinants of mortality, in order to establish pathways to mortality and highlight the multi-causal nature of under-two mortality. The aim is to establish which of the determinants of mortality are also related to migration status, allowing the identification of indirect routes through which migration status can influence mortality.

In the previous logistic models the dependent variable has been the survival status of the child in each mortality period analysed. In this section each of the variables that proved to be significantly related to mortality in the logistic and multi-level logistic modelling processes is now taken in turn as the dependent variable, such that a further 15 logistic models are fitted in order to determine the factors associated with each of the individual determinants of mortality.

6.6.1 Bio-demographic Determinants of Mortality

Table 6.6 displays the summarised results of the logistic models fitted to establish those factors associated with each of the bio-demographic determinants of mortality used in chapter four: birth interval, prematurity, size of child at birth, and consanguinity. It is apparent that the factors related to the bio-demographic determinants of mortality are generally those that are indicative of the socio-economic status of the mother and characteristics associated with pregnancy and health care utilisation. This suggests that rather than being purely the product of individual biological characteristics, such determinants of mortality are in fact influenced by other aspects of individual behaviour.

The risk of experiencing a short birth interval (<18 months) proved to be significantly associated with variables indicating the socio-economic status of the respondent. Women who recorded receiving some level of education proved to have lower risks of experiencing short birth intervals than illiterate women, the risk declining with an increase in education level. Those women with primary education had a 15% lower risk of experiencing short birth intervals (OR 0.85) relative to illiterate women, among those with higher education the risk was 27% lower (OR 0.73). Education may provide the knowledge necessary for women to control birth spacing through the adoption of modern contraceptive methods, and increase personal autonomy and control over their reproductive behaviour. In addition, the increased likelihood of working outside the home that accompanies higher levels of education may encourage the spacing and limiting of births as the woman moves away from more traditional domestic roles.

Caste and the standard of living index were also significantly related to the risk of experiencing short birth intervals. Those in the 'other' castes displayed a 10% lower risk of having birth intervals of less than 18 months than those in the scheduled castes (the socio-economically inferior castes). Women with a standard of living index below the middle category had a 25% higher risk of experiencing short birth intervals than those in the upper middle category. The socio-economic status of the woman would thus appear important in determining this aspect of her reproductive behaviour. A higher socio-economic status may indicate a high level of education, thus socio-economic status would influence birth intervals in a similar way to education by increasing female autonomy and power in reproductive decision making. In addition, a higher socio-economic status may indicate greater resources available for the uptake of contraceptive methods that may be used to space births, or the utilisation of health care services that can provide information on the potential consequences of short birth intervals.

There proved to be inter-relationships between birth intervals and other bio-demographic variables, with the mother's age at the birth of the child, parity, and the survival status of the previous child all significantly related to the risk of experiencing short birth intervals. Higher parities are associated with a lower risk of short birth intervals than parities 1-2 (OR 0.17), and the risk of short birth interval would appear to decline with parity. Increasing parity and maternal age are associated with a decrease in fecundity, and hence longer previous birth intervals are more probable at older ages and higher parities. This would also explain the relationship found between the age of the mother at the time of the birth and the risk of a short birth interval, which showed mothers aged over 35 years 40% less likely to have a birth interval of less than 18 months than those aged 20-24. The risk of experiencing short birth intervals declines after the peak child bearing ages of 19-29, suggesting that contraceptive methods are used mainly for child limitation rather than child spacing. Alternatively, this may reflect a decline in fecundity with age, such that the risk of having children, and consequently a short birth interval, declines at older ages.

Those whose previous child had died showed a 50% greater risk of experiencing a birth interval of less than 18 months when compared to those whose previous child was still alive at the time of the survey. The loss of a previous child may shorten the amount of time that the woman would be breast feeding, thus shortening the amenorrhoeic period and increasing the risk of pregnancy through the loss of the natural contraceptive effects of breastfeeding. Alternatively, the process of child replacement may be taking place, in which the death of a child is followed by a pregnancy to replace the lost child. Symala and Roy (1994) found that this process was in operation in Goa, where the average family size was 2.2 children higher if the mother had experienced the loss of a son. Hence, the finding here would appear to be consistent with those found in previous studies of reproductive behaviour in India.

Migration status proved to be significantly related to the risk of experiencing a birth interval of less than 18 months. Relative to rural-urban migrants, those who remained in rural areas displayed a 40% greater risk of short birth intervals, whilst among the urban non-migrants the risk was 31% higher. The greater risk of experiencing shorter birth intervals among rural and urban non-migrants relative to rural-urban migrants may be due to the presence of spousal separation among the migrant population. When moving from a rural to urban area it is common for the husband to migrate first, in order to establish a home and income to support his family. This period of separation will reduce the chance of conception, and hence increase birth intervals among the migrant population.

The risk of experiencing a premature birth was determined by factors indicating the utilisation of health care during pregnancy. Those receiving ante-natal care in the first trimester displayed a 21% lower risk of delivering a premature birth than those waiting until the last two months of pregnancy to receive care. The receiving of tetanus toxoid injections during pregnancy, an indicator of the propensity to seek out health care, was associated with a 27% lower risk of experiencing a premature birth relative to those not receiving injections. These results highlight the potential protective nature of ante-natal care during pregnancy.

Relative to singletons, multiple births are associated with a four-fold increase in the risk of experiencing a premature birth. Gandotra, Das and Dey (1982) suggest that this may be due to the increased biological demands that the carrying of multiple births places on the body during pregnancy, reducing the body's ability to support both foetuses for the full gestation period. If the previous child had died, the respondent had a 54% greater risk of experiencing a premature birth. This may be due to one of two reasons. The process of child replacement after the loss of a child leads to shorter birth intervals, which in turn may increase the likelihood of a premature birth if the woman's body has not yet fully recovered from the physical and nutritional demands of the previous child. Alternatively, a previous child death may indicate the presence of genetic disorders which would limit the woman's ability to carry a foetus to the full gestation.

There was no statistically significant difference in the risk of premature birth between women of differing levels of education or any of the other indicators of socio-economic status. This suggests that the determinants of prematurity are largely biological. However, the uptake of ante-natal care would appear to act as a method of preventing prematurity through the monitoring of foetal growth and the identification of developmental abnormalities.

The INFHS (1992) collects information on the size of the child at birth by recording the mothers opinion on the child's size, which is categorised as small, medium or large. A model was fitted to determine those factors associated with the risks of having a small child. As with the risk of prematurity, the utilisation of antenatal care proved to be significant in determining the risk of producing a small baby. Those who had received ante-natal care were 74% less likely to have a low birth weight baby, once again highlighting the role the ante-natal care plays in monitoring foetal growth.

There was no difference between illiterate women and those with primary education in terms of their risks of producing a small baby, but women with higher education proved to have a 31% lower risk of having a low birth weight baby. Once again this may be due to disparities in both knowledge of and access to health services between educated and uneducated women. Those women categorised as having a standard of living below the middle category were 22% more at risk of having a small baby than those in the upper middle category, whilst those in the other castes displayed a 16% lower risk of having low birth weight babies than those in the scheduled castes. The socio-economic differentials witnessed in the risk of low birth weight babies suggests the presence of differential health seeking behaviour and nutritional resources to support pregnancy between socio-economic groups. Such factors appear to be more influential in determining size of the child than they were in determining prematurity, highlighting the essentially biological causes of prematurity compared to birth weight which would appear to be influenced by a much wider range of factors.

Table 6.6 shows that the entering into a consanguineous marriage is associated with indicators of socio-economic status and geographic location, the latter reflecting the cultural differences that exist in marriage behaviour between states. Among those with education of primary and above the risk of entering a consanguineous marriage is lower than among illiterate women (primary level OR 0.11 higher + OR 0.74). This may be due to the higher degree of female autonomy and personal decision making that can accompany higher levels of education, resulting in a greater freedom for educated women to choose their own marriage partners (Krishnamoorthy and Audinarayana 1998).

In India, consanguinity is usually associated with the Muslim population, although in southern states the practice is present among all religious groups. This religious differential was found in the logistic modelling of consanguinity which showed that Muslims had a 74% greater risk of marrying a relative than Hindus. This suggests that the survival disadvantage associated with consanguinity is concentrated predominantly into one religious group, indicating the presence of mortality differentials by religion.

The state in which a respondent lives is significantly associated with the chances of entering a consanguineous marriage. The states with the highest odds of women entering into consanguineous marriages were the northern states of Orissa, Punjab, Rajasthan, and Madhya Pradesh, relative to the reference category of Kerala. This reflects the concentration of the Muslim population in the northern states of India, and is also indicative of the differing north-south kinship structures.

There was no statistically significant difference in the odds of entering into a consanguineous marriage between rural-urban migrants and rural-non migrants. However, urban non-migrants proved to be less likely to marry a relative (OR 0.13) than rural-urban migrants. This suggests that the traditional marriage practices prevailing in rural areas are maintained among the rural-urban migrant population, and indicates that the urban population may have more freedom in their marriage behaviour than their more traditional rural counterparts.

Table 6.6: Relationships between bio-demographic determinants of mortality and other correlates of mortality

	Migration	Socio-Economic					Bio-Demographic				Health Care		Spatial
	Migration	Caste	Religion	SLI	Maternal education	Media exposure	Prematurity	Multiple birth	Previous child died	Mothers age at birth of child	Received tetanus injection	ANC in first trimester	State
Birth interval <18 months	✔	✔	✔	✔	✔	✗	✗	✗	✔	✔	✗	✗	✗
Premature birth	✗	✗	✗	✗	✗	✗	✗	✔	✔	✗	✔	✔	✗
Small baby	✗	✔	✗	✔	✔	✗	✗	✗	✗	✗	✔	✔	✗
Consanguineous marriage	✔	✗	✔	✗	✔	✗	✗	✗	✗	✗	✗	✗	✔

✔ Significant relationship at 5% level ✗ No significant relationship

6.6.2 Health Care Utilisation Determinants of Mortality

Table 6.7 displays the summarised relationships between those variables indicating health care utilisation which proved to be significantly related to mortality in the logistic and multi-level logistic modelling processes and the other determinants of mortality. Indicators of socio-economic status are related to each of the variables indicating the utilisation of health care during pregnancy and the place of childbirth. Those in the 'other' castes have a greater odds of receiving ante-natal care (OR 1.5), receiving tetanus toxoid and iron folic acid tablets during pregnancy (OR 1.2 and 1.3) and delivering their children in a formal institution (OR 1.6) than those in the socio-economically inferior scheduled castes. These results suggest that the socio-economic status of the lower castes limits their access to health care during pregnancy. However, the caste groups used in the INFHS data are very broad, the category 'others' includes a wide range of caste groups, hence the results from using this variable should be treated with some caution.

Differential uptake of maternal health care services is apparent between educational groups. In each indicator of health care use there exists a greater odds of utilising the service among both the primary educated and high-plus educated women than in those who are illiterate. Those who receive education of secondary level and above are four times more likely to deliver their children in a formal institution (government or private hospital) than illiterate women, and display a 70% greater odds of receiving ante-natal care during the first trimester of pregnancy.

Such educational differentials may be attributed to increased knowledge of the availability of services which may accompany the achieving of high levels of education (Singh and Pawar 1983). It seems plausible to suggest that those reaching higher levels of education are more likely to be involved in paid work outside the home, increasing both the resources available for the utilisation of services and access to services through the association with social networks outside the home. Indeed, the utilisation of health care proved to be associated with high levels of exposure to media (television, radio, and newspapers), suggesting that communication with the wider society outside the home is important in influencing a woman's decision to access maternal health care.

Variables indicating both individual socio-economic status and the environmental conditions of the household are related to the odds of utilising health services during pregnancy. Those with a standard of living index above the middle category have a greater odds of receiving ante-natal care (OR 1.46), receiving tetanus toxoid injections and iron folic acid tablets during pregnancy (OR 1.17 and 1.40), and are more likely to deliver their children in a formal institution (OR1.53) than those categorised as having a standard of living below the middle category. The presence of toilet facilities in the household and the use of piped water sources were associated with a higher uptake of health care services when compared with those using less formal facilities. Those living in pucca housing display greater odds of receiving ante-natal care (OR 1.33), are more likely to utilise services in the first trimester of pregnancy (OR 1.11), and have a 66% greater odds of delivering their children in hospitals than those in kaccha and semi-pucca housing.

The place of delivery proved to be associated with other indicators of health care utilisation. Those receiving ante-natal care in the first trimester of pregnancy, and those receiving tetanus toxoid and iron folic acid tablets displayed greater odds of experiencing childbirth in a medical institution when compared to women not in receipt of such services. These results suggests that the use of a particular health service may influence the decision to use other health services, and that those women who seek health care during pregnancy are the most likely to utilise formal services throughout the pregnancy and child birth. The odds of receiving tetanus toxoid injections during pregnancy is associated with the uptake of iron folic acid tablets. Tetanus toxoid injections and iron folic acid tablets are received at the same time in pregnancy, hence if a woman receives one of the services it is likey she will receive the other.

The modelling showed that it was not only the uptake of antenatal care that was affected by individual socio-economic characteristics, but also the stage of pregnancy at which antenatal care was sought. It has been suggested that antenatal care visits should begin in the first trimester of pregnancy, with monthly visits for the first seven months, followed by fortnightly visits in the eight month and weekly visits in the final month of pregnancy (MacDonald and Pritchard 1980). However, this ideal number of visits is often impossible to achieve in an environment where the resources and time needed to attend antenatal care are scarce. Given this, the Indian Child Survival and Safe Motherhood Programme aims to provide at least three antenatal care check-ups to all pregnant women, with the ideal of starting antenatal care in the first trimester of pregnancy (INFHS 1992). The receiving of antenatal care during the first trimester of pregnancy is important for the early detection of foetal growth abnormalities, and provides an opportunity to identify high risk pregnancies.

Socio-economic variables proved to be important predictors of the odds of utilising antenatal care in the first trimester. The logistic modelling of the timing of antenatal care found that those with primary and secondary level education were more likely to receive antenatal care in the first trimester than illiterate women (OR Primary 1.63, Secondary 1.32). This suggests that an increased level of education provides both the resources to attend antenatal care and the knowledge of the importance of early antenatal care visits. Those with a standard of living index below average displayed a greater odds of delaying antenatal care until the third trimester (OR 1.42), than those with a higher standard of living. Women living in kachha houses (OR 1.62) and living in crowded houses (1.34), all displayed high odds of not receiving antenatal care until the final trimester of pregnancy. There is a clear socio-economic divide in the early uptake of antenatal care, with the utilisation of services in the first trimester more prevalent among women with indicators of a higher standard of living. Access to services among the poor is limited by a combination of money, time and a lack of knowledge of service availability.

Higher parity births (4+) have a lower odds of being delivered in a hospital than those at parity 1-3 (OR 0.74). This result may indicate the practice of switching behaviour in childbirth, with lower parity births delivered in hospital followed a switch to home births at higher parities. Such behaviour may be due to increased experience of child birth which accompanies an increase in parity, such that the mother feels that the security provided by the hospital environment is no longer necessary for higher parity births (Kausar 1998). Also, the time needed to attend hospital for a birth may not be available to women who already have young children to care for, hence high parity births may be more likely to take place at home.

The state in which the respondent lives proved to be significantly associated with all indicators of health care utilisation. There appears to be a north/south divide in the uptake of maternal health care services, with women in the northern states having the lowest odds of receiving ante-natal care, tetanus toxoid injections, iron folic acid tablets, and delivering in a hospital when compared with women living in Kerala. Other southern states display lower odds of maternal health care uptake than Kerala, suggesting that there are differential rates of uptake within the broadly defined north and south of India. The apparent geographical dichotomy in health service uptake suggests the presence of a child survival disadvantage in those northern states that have low levels of health care utilisation, given that the modelling of mortality showed such utilisation to be important in determining infant survival. Griffiths (1998) suggests that the kinship structure present in northern states limits female autonomy and consequently the access to health care services.

Migration status displayed a significant relationship with each of the indicators of health care utilisation. Relative to rural-urban migrants, urban non-migrants have a 22% greater odds of receiving ante-natal care, a 13% lower odds of waiting until after the first trimester to receive ante-natal care, and have a 30% greater odds of delivering children in a hospital. There is, however, no difference in the odds of receiving tetanus toxoid injections or iron folic acid tablets during pregnancy between urban non-migrants and rural-urban migrants. Conversely, rural non-migrants have a 68% lower odds of receiving ante-natal care, are 24% more likely not to receive any care until the last trimester of pregnancy, and have a 20% lower odds of receiving tetanus toxoid and iron folic acid tablets than their rural-urban migrant counterparts. Rural non-migrants also have a 60% lower odds of giving birth in a hospital than rural-urban migrants. These results suggest that there are three distinct patterns of maternal health care use. The urban pattern, characterised by high levels of ante-natal care uptake, including care during the early stages of pregnancy and the receiving of preventative medicines. In contrast, the rural pattern is characterised by low levels of service uptake and a reliance upon home delivery. The rural-urban pattern would appear to be an amalgamation of the urban and rural patterns. Rural-urban migrants have higher levels of health service uptake than those remaining in the rural origin, yet appear not to reach the same levels of service use found in the urban destination. The similarity in the uptake of tetanus toxoid and iron folic acid tablets between rural-urban migrants and urban non-migrants suggests the success of these services in reaching all sectors of the urban community. The importance of health care utilisation in determining child survival, as shown in the modelling of mortality, suggests that the differences in service utilisation between migrant groups may be instrumental in creating mortality differentials between rural-urban migrants and non-migrants. The differential utilisation of prenatal care services between rural-urban migrants and non-migrants is examined further in Chapter 7.

Table 6.7: Relationships between utilisation of maternal health care services and determinants of under-two mortality

	Migration	Socio-economic						Bio-demographic	Health care				Spatial
	Migration	Caste	Maternal education	SLI	Toilet	Water Source	House type	Parity	Received ANC	ANC in 1st trimester	Tetanus	Iron tablets	State
Received ANC	✔	✔	✔	✔	✔	✔	✔	✔	★	★	★	★	✔
Received ANC in first trimester	✔	✔	✔	✔	✔	✔	✔	✔	★	★	★	★	✔
Received iron tablets	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	★	✔
Received tetanus injection	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	★	✔	✔
Delivered baby in formal facility	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔

✔ Relationship significant at 5% level ✗ No significant relationship ★ Variable not entered in model

6.6.3 Socio-economic and environmental determinants of mortality

Table 6.8 displays the relationships between the socio-economic and environmental determinants of mortality and other factors associated with under-two mortality. It is apparent that there is a strong pattern of inter-relationships between the socio-economic and environmental determinants of mortality, with the possession of one indicator of inferior household conditions associated with other indicators of low socio-economic status. Maternal education displays significant relationships with each of the indicators of household environmental conditions. Those with levels of education of primary and above have lower odds of living in crowded houses, living in kaccha housing, and using informal toilet facilities and water sources, than illiterate women. These results indicate a link between education and living conditions, that those with higher levels of education have the resources available to provide themselves with higher standards of living than found among the illiterate population. Conversely, this may also indicate that those respondents who achieve higher levels of education are those originating from household environments indicative of a higher standard of living.

The facilities available within a household are associated with the type of house. Those living in kaccha housing display greater odds of using non-piped water sources, informal toilet facilities, and of having a standard of living index classified as below the middle category, than those living in pucca housing. Those households utilising informal toilet facilities are also more likely to be crowded and depend upon non-piped sources of water. The associations between the characteristics of the household indicate the presence of an inferior living environment among the poorest sectors of the population, characterised by a dependence upon informal sanitation facilities, high levels of household crowding, and a concentration in semi-pucca and kaccha housing.

The state in which a respondent lives proved to be significantly related to each of the environmental determinants of mortality, once again highlighting the socio-economic diversity of India. Women living in the northern states of Orissa, West Bengal, Rajasthan, and Uttar Pradesh showed the greatest odds of having the least favourable categories of each of the environmental conditions modelled, when compared to the reference state Kerala. These results suggest the inferior economic position of these states in relation to

Kerala, and highlight the continuing disparity in household environmental conditions across India. Given that the physical environment in which a child is raised has been shown to be significant in determining survival prospects, disparities in environmental conditions between states may act to explain the presence of state-level infant and child mortality differentials.

Migration status was significantly related to each of the indicators of household environmental conditions. Rural non-migrants were almost three times more likely to live in kaccha housing (OR 2.8) than rural-urban migrants, were seven times more likely to utilise informal toilet facilities, and display a 70% greater odds of having a standard of living below the middle category. There was no significant difference between rural non-migrants and rural-urban migrants in the risk of living in crowded houses, or in the use of non-piped water sources. Relative to rural-urban migrants, urban non-migrants displayed lower risks of utilising informal water and toilet facilities, yet there was no significant difference in the risks of living in kaccha housing. Urban non-migrants have a 37% greater odds of living in a crowded house than rural-urban migrants. Therefore, it would appear that the worst of the environmental conditions are to be found in rural areas, where there appears to be a dependence upon informal sanitation facilities and kachha housing. In migrating to urban areas, rural-urban migrants are moving away from this environment, yet appear not to be assimilating completely with the host urban society in terms of their standards of living. Those who have always been resident in the urban area show lower odds of utilising informal sanitation facilities than recent migrants, suggesting the concentration of migrants in the socio-economically inferior sectors of urban society. The lack of differences in the odds of living in kachha housing between urban non-migrants and rural-urban migrants indicates that this form of housing is a predominantly rural phenomena. Urban non-migrants display a greater odds of living in a crowded house. This may be a result of two processes. Firstly, the cost of land in urban areas relative to that found in rural areas encourages the crowding of families into smaller houses. Also, the literature reviewed in Chapter 2 suggested that migrants break away from extended families in rural areas when migrating and form nuclear families at their urban destination, hence the average family size of those new to the city may be smaller than the non-migrant population. It is possible that migration between rural and urban areas involves the transition from extended to nuclear families, this will be explored further in Chapter 7.

The differences in the environmental conditions between migrants and non-migrants have obvious connotations for explaining the presence of mortality differentials between the groups. The rural areas, characterised by poor sanitation and informal housing, have the highest rates of mortality in each of the periods analysed, and it would seem plausible to suggest that there is a link between the physical environment and the risk of experiencing under-two mortality. In migrating, rural-urban migrants appear to increase their standard of living, through a reduction in the risk of living in kachha housing and an increased utilisation of more formal sanitation facilities. However, those who have always lived in the urban areas maintain the highest standards of living, as indicated by type of house and the facilities used, suggesting the presence of a migrant under-class in urban areas, whom it would appear are more likely to live in inferior environmental conditions. The greatest differentials in survival between the urban non-migrant and rural-urban migrant groups are witnessed in the post-neonatal and toddler periods. Environmental conditions proved to be significantly related to mortality in these periods, suggesting that the presence of disparities in living conditions between the two populations may act to explain the continuing mortality differentials.

Table 6.8: Relationships between socio-economic determinants of mortality and other correlates of mortality

	Migration	**Socio-economic**							**Spatial**
	Migration	Caste	Religion	Maternal education	House type	Media exposure	SLI	Water source	State
Crowded house	✔	✔	✔	✔	✔	✔	✔	✔	✔
Kaccha house	✔	✔	✔	✔	★	✔	★	✔	✔
Informal water source	✔	✔	✔	✔	✔	✗	★	★	✔
Informal toilet facility	✔	✔	✔	✔	✔	✗	★	★	✔
Low SLI	✔	✔	✔	✔	✔	✗	★	✗	✔

✔ Relationship significant at 5% level ✗ No significant relationship ★ Variable not entered in model

6.7 Discussion

The purpose of this chapter was to establish the factors which act to control for mortality differentials between migrant groups, in an attempt to highlight the pathways through which migration status may influence under-two mortality. The logistic modelling of mortality displayed significant gross effect relationships between migration status and mortality in both the neonatal and late post-neonatal and toddler periods, suggesting that it is in these two periods that the impact of rural-urban migration on mortality is greatest. There appeared to be no significant relationship between migration status and the risk of experiencing early post-neonatal mortality, even in the absence of other determinants of mortality. In the neonatal period, the major differences in the risk of mortality were found between rural-urban migrants and rural non-migrants, and there was no significant difference between migrants and urban non-migrants. However, in the late post-neonatal and toddler period the risk of experiencing mortality for the rural-urban migrant group was between that of the urban destination and the rural origin, replicating the three level relationship between migration and mortality suggested by Brockerhoff (1994). These results indicate the similarity between those living in urban areas in terms of their risks of experiencing neonatal mortality, and the presence of urban-rural differentials in neonatal mortality. At later ages, the socio-economic disparities among the urban population act to create mortality differentials between urban non-migrants and rural-urban migrants, whilst differentials persist between urban and rural areas, suggesting greater variations in the determinants of mortality in the late post-neonatal and toddler period.

The introduction of each of the categories of mortality determinants into the modelling process showed that individual socio-economic characteristics were influential in explaining the relationship between migration and mortality in all three periods analysed. In both the neonatal and late post-neonatal and toddler periods, the introduction of maternal education and the standard of living index resulted in the disappearance of the significant relationship between migration and mortality that had been present in the gross effects model. Therefore, the level of female education and the associated standard of living would appear to be of prime importance in determining mortality risks in these periods. Given this, the presence of educational differentials between the migrant groups, particularly the educational selectivity of rural-urban migrants, may act to explain mortality differentials between migrant populations.

The utilisation of maternal health care was significantly related to mortality in all three periods analysed, and was also influential in altering the significance of the relationship between migration status and mortality. The introduction of variables indicating the uptake of maternal health care services resulted in the lack of a significant relationship between mortality and migration. This suggests that mortality differentials witnessed in the preliminary analysis can be explained by differential uptake of maternal health care between migrant groups. It has been noted that the provision, and consequently the uptake of, maternal health care in rural India is inferior to that found in urban areas. Hence, it would seem plausible to suggest that in migrating, women are moving from rural areas with low levels of service provision to urban areas with a greater service availability, and are, hence, more likely to utilise such services.

Logistic modelling was used to establish the links between each of the determinants of under-two mortality. It was discovered that bio-demographic determinants were largely influenced by health care utilisation and socio-economic characteristics, indicating that the impact of the biological determinants of mortality are influenced by the health care behaviour and socio-economic background of the individual. Health care utilisation is largely determined by individual socio-economic characteristics, with those achieving levels of education beyond primary and having indicators of a higher standard of living displaying the greatest odds of receiving each of the services modelled. There exist inter-relationships between the indicators of health service utilisation. This result suggests that there exists a particular health seeking behaviour, in which an individual who is likely to utilise one particular health service is similarly predisposed to utilise all maternal health care services. It may be argued that such behaviour exists among the higher educated members of the sample, who display the highest rates of uptake in each of the maternal health care services.

The environmental conditions of the household proved to be determined by the socio-economic characteristics of the respondent, indicating the link between socio-economic status and the ability and knowledge to provide a hygienic living environment. Inter-relationships were apparent between the indicators of household environmental conditions, with those living in kachha housing also likely to possess each of the least favourable of the remaining indicators.

Migration status proved to be related to each of the indicators of maternal health care utilisation and household environmental conditions, yet, with the exception of birth intervals, was not significantly related to the bio-demographic determinants of mortality. The lack of relationships between migration and bio-demographic factors indicates the essentially biological nature of such factors which are less likely to be subject to geographical variations than the other determinants of mortality. The results highlight the importance of migration status in determining access to maternal health care, suggesting that although migration to an urban area increases the availability of health care services relative to those found in the rural areas, it does not necessarily result in equality in service uptake between rural-urban migrants and urban non-migrants.

The relationships between migration status and household environmental conditions show that there are differences in the standards of living between rural and urban areas. Rural areas are characterised by a concentration in semi-pucca and kachha housing, and a reliance upon informal sanitation facilities. In contrast, urban areas have a higher percentage of pucca housing, and have lower percentages of their population utilising informal sanitation facilities. In migrating to an urban area, rural-urban migrants improve their standard of living from that found in their rural origin, yet appear not to assimilate into the host urban society. The higher levels of inferior housing conditions among rural-urban migrants suggests the presence of an urban migrant underclass, attributable to their lower socio-economic status.

The results suggest evidence of a three-level relationship between migration status and each of the determinants of mortality. Those in the rural areas appear to have the least favourable indicators, the urban non-migrants possess the most favourable indicators, whilst the rural-urban migrants have indicators of child survival prospects that are between the urban and rural environments. It is the distribution of the determinants of mortality across the migrant groups that acts to create the mortality differentials that were apparent in the gross effects models. The links between migration status and the determinants of mortality suggest that there are indirect routes through which migration may influence under-two mortality.

Socio-economic status, as indicated by the level of education and standard of living index, was shown to be linked to both the utilisation of maternal health care services and the place of delivery used for childbirth. In addition, socio-economic status is also related to household living conditions, with those holding the higher levels of socio-economic status also possessing the most favourable household conditions.

Bio-demographic factors are linked to both the utilisation of health care services and socio-economic status, suggesting that individual behaviour and the uptake of formal health services can influence the effects that biological determinants have on mortality. The place of delivery used for childbirth is linked to the use of other maternal health care services, indicating that there exists a health seeking behaviour in which those who choose to utilise formal health services are also more likely to deliver their children in formal institutions. These results may also reflect differences in access to maternal health care services, with those who do not have access to prenatal care also not having access to medical institutions for child delivery, and thus are more likely to deliver their child at home.

Migration status has been shown to be linked to household environmental conditions, socio-economic status, and the utilisation of maternal health care services, all of which have demonstrated relationships with the risk of mortality in each of the age groups analysed. Given this, migration status may act through these categories to influence the risk of mortality among the migrant population. The failure of migration status to be directly linked to mortality in the logistic modelling process was due to the inclusion of a variety of factors which acted to control for the noted socio-economic and health care differentials between migrant groups. This analysis has highlighted those factors that act to explain the relationship between migration and mortality. It is, therefore, suggested that the relationship between migration and mortality, which exists in the neonatal and late post-neonatal and toddler groups, is a product of the unequal distribution of the determinants of mortality across migrant groups. In particular, the utilisation of maternal health care services, which is strongly related to mortality, has been shown to differ greatly between migrant groups. The differences between rural and urban areas in terms of service utilisation appear to be due to inequalities in service provision. However, the differences found between rural-urban migrants and urban non-migrants are less easily explained. Such intra-urban differentials require more information to provide a view of the mechanisms through which urban non-migrants and rural-urban migrants seek to utilise health care, and the decision making behaviour which influences service use.

Chapter 7 provides more information on the utilisation of maternal health services among migrant groups, using a qualitative methodology to describe the attitiudes towards health services use and the decison making behaviours prevalent in migrant and non-migrant groups in Mumbai.

Chapter 7

Utilisation of Maternal Health Services Among Migrant Groups: A Case Study of Mumbai

7.1 Introduction

The logistic and multi-level logistic analysis of child mortality highlighted the importance of the utilisation of maternal health care services in determining the survival prospects of the child. The uptake of antenatal care, the frequency of antenatal care visits, and the receiving of tetanus toxoid injections during pregnancy all proved to be significantly related to the risk of mortality in each of the age groups analysed. This chapter presents the results of qualitative research which examined the utilisation of maternal health care services among rural-urban migrants in Mumbai.

The data from the Indian National Family Health Survey (1992) show a differential utilisation of maternal health care services between migrants and non-migrants. The uptake of antenatal care is over 70% among those living in urban areas (urban non-migrants and rural-urban migrants), whilst among rural non-migrants the level of uptake is much lower at only 45%. This pattern of service utilisation may reflect the differences in the availability of health services between urban and rural areas of India, but it is also possible that differences in attitudes to health service utilisation exist between urban and rural environments.

Among those who utilise antenatal care there are differences in the patterns of use. Antenatal care use among rural non-migrants is characterised by uptake at the later stages of pregnancy, with less than 15% of those receiving antenatal care during the first trimester, compared to approximately 40% of urban non-migrants and rural-urban migrants. Antenatal care is particularly important during the first trimester in detecting abnormalities in growth and development of the child (Rodriquez et al. 1985), and, hence, failure to receive care during this period may be detrimental to child survival. Therefore, from the INFHS data it would appear that low levels of uptake of ante-natal care services during the early months of pregnancy among rural populations may lead to survival disadvantages among children born in rural areas.

Tetanus toxoid injections should be received twice during pregnancy, the first dose between 16 and 24 weeks of pregnancy and the second dose between 24 and 32 weeks gestation. The objective of this injection is to prevent the development of tetanus in both the mother and child, as neonatal tetanus is a major cause of death in many of the northern states of India (Luther 1998). Receiving two tetanus toxoid injections provides 100% protection against tetanus among newborns and mothers (IIPS 1993). Over 70% of those living in urban areas received two doses of tetanus toxoid during pregnancy, compared to less than 40% of rural residents. Again, this suggests that those in rural areas have a greater risk of infant death due to their low utilisation of preventative maternal health services.

Given the demonstrated importance of the utilisation of maternal health care services as determinants of child survival, it seems plausible to suggest that any differential uptake of such services between migrants and non-migrants may act as a potential explanation for mortality differentials between migrant groups. The INFHS (1992) data show that the main difference in the utilisation of maternal care services exists between rural and urban areas, and not between migrant groups, with rural-urban migrants appearing to have similar usage patterns to urban non-migrants. However, differences may be apparent between migrant groups in the types and quality of prenatal services used, data that are not available from the INFHS.

The INFHS data (1992) relating to the use of maternal health care is, however, limited. The survey recorded only whether or not the respondent received antenatal care, or tetanus toxoid and iron folic acid tablets during pregnancy, and the number of months pregnant at which the respondent first sought care. Although these data provide an indication of the levels of utilisation of health services, it cannot provide information on the perceived quality of services used or the motivation behind the decision to use, or indeed not to use, maternal health care. Previous research shows that the quality of health care services differs greatly between rural and urban areas of India (Prasad 1997; Archarya and Kanatikar 1994), and thus it seems possible that by migrating between rural and urban environments, migrants are changing their exposure to health services of differing qualities. Therefore, migration may lead to a change in the utilisation of maternal health care services, or a change in the type of services used, which in turn has consequences for potential improvements in child survival. In order to examine the possibility of differential utilisation of maternal and child health care services between migrants and non-migrants, qualitative research using an in-depth case study methodology was conducted in Mumbai, between February and June 1998. This chapter discusses the aims, methodology and results of the qualitative research, and examines the relationship between migration status and the decision to utilise maternal health care services.

7.2 Aims

The principal aim of the qualitative research is to examine the effect of rural to urban migration on the utilisation of maternal and child health care services, in an attempt to explain the relationship between migration status and mortality. The INFHS (1992) data can provide an insight to rates of service uptake. However, this qualitative work aims to examine the types of services used and the reasons behind their use, allowing an in-depth comparison of migrant and non-migrant groups. The case studies aim to identify possible explanations for any differences in the utilisation of maternal health care services between migrant and non-migrant populations. Such differential utilisation of health care services may be explained by one, or a combination of two theories. Firstly, migration may be selective of those with socio-economic characteristics predisposing the use of health care services. Secondly, migration may lead to the creation of an urban under-class with inferior access to health care services, a product of the difficulties experienced by migrants in socially and economically assimilating into the host urban society.

The qualitative research also aims to collect data on aspects of migration status not included in the INFHS (1992), in an attempt to increase the understanding of the motivations behind migration and the process through which migrants adapt to their new urban environment. This will also allow the identification of specific characteristics of migrants which may be associated with the utilisation of maternal and child health care services.

7.3 Objectives

The qualitative research has three objectives. Firstly, to identify and compare the nature, prevalence and typology of maternal and child health service utilisation by migrant and non-migrant populations. In addition, the research aims to identify key social, cultural, and economic influences on service utilisation by migrant and non-migrant populations, and to examine how such determinants differ by migration status. The collection of such data will allow any behavioural differences in service utilisation between migrant populations to be identified, and establish the extent to which such differences are the result of socio-economic characteristics or factors associated with migration status. Finally, the research will identify and compare individual characteristics of migration status (place of origin, distance moved, reasons for moving), in order to increase the understanding of the differences between the migrant and non-migrant populations and the factors which influence individuals to use health services.

7.4 Study Setting

Mumbai, formally known as Bombay, is presently the most populous city in India, with a population in 1997 of over 17 million (IIPS 1993). The city is also a major destination for rural-urban migrants, with approximately 25% of the city's population migrating from rural areas in the last ten years. Given the size of the city, its position as a destination for migrants, and the presence of large socio-economic differentials among its population, Mumbai provides an ideal setting for the study of migrants in a major urban area. As this study examines the differential utilisation of maternal health care services between migrants and non-migrants it is necessary to have three study populations that represent the migrants, their urban destination and their rural origin. In order to provide such populations two study settings were identified: an urban area in which to identify both urban non-migrants and rural-urban migrants, and a rural area in which to identify rural non-migrants. The two study settings are as follows:

Rural setting: Sikhwai Village, Khanavide District, Maharasthra:

Sikhwai village has a population of approximately 300 and lies 200km north of Mumbai. The village is based around an agricultural economy, which provides the main source of employment. The village contains the Ramakrishna Mission, a charity funded rural health and welfare centre, which provides health services for people from the village and the surrounding Khanavide district. The health centre has facilities for vaccinations, the treatment of common illness, dental and ophthalmic problems, and ante-natal care. Services are provided free of charge, and the mission is only able to provide services one day per week (Sunday) due to the costs of keeping the centre open. The Ramakrishna Mission also operates balwadis (pre-primary schools), agricultural demonstrations, and tailoring courses in the village, which are aimed at increasing employment skills and agricultural productivity in the village. The nearest government operated hospital is in Madvi, which is over one hour's drive from Sikhwai.

The 1991 Census of India reports that 25% of villages in Maharashtra have a population of 200-499. In addition, 47% of all rural households in Maharashtra are semi-pucca, and 17% are kaccha, whilst 33% of all rural households use informal water sources. The Sikhwai village has a population of approximately 300, and is comprised of predominantly semi-pucca and kaccha housing. The public wells provide the main source of water. Thus, in terms of these characteristics, the Sikhwai village appears to be typical of a large percentage of Maharasthran villages. The 1991 Census also reports that only 8.4% of villages in Maharasthra have a medical dispensary, hence in terms of the health facilities available, Sikhwai represents only a small percentage of villages in Maharashtra.

Urban Setting: Siv Sakti Nagar, Vashi, Mumbai:

Siv Sakti Nagar is a slum area situated in sector 17 of the Vashi area of Mumbai. Vashi is locally known as "New Bombay", and is an area of new industrial and commercial development built upon reclaimed land that has become a focus of in-migration from surrounding rural areas. Siv Sakti Nagar is the largest and most populous slum in Vashi, and was chosen due to the high concentration of recent rural-urban migrants in this area. Health and pre-school education in the slum are provided by the charitable organisation *Seth* (Hindi word meaning "Health"), which provides balwadis and advice on health and family planning. Formal health services are available in the form of a government hospital, and a number of private health practitioners, both approximately half an hour by vehicle from the slum.

The Indian Census does not report the socio-economic characteristics of individual slums, so it is difficult to establish how typical Siv Sakti Nagar is of the slums in Mumbai. However, the 1991 Census does report that 36% of households in Mumbai are semi-pucca, and 11% are kaccha. In addition, 79% of households in Mumbai have access to a formal water supply. Siv Sakti Nagar is comprised of predominantly of semi-pucca housing, and public taps provide the main source of water. Hence, in terms of these characteristics, Siv Sakti Nagar appears to represent a typical slum in Mumbai. The Census does not report the health facilities available in each slum. However, observations from the field suggest that small health facilities, operated either privately or by charities, are common in Mumbai. Thus the charity operated *Seth* facility in Siv Sakti Nagar appears typical of the health facilities found in many Mumbai slums.

7.5 Methodology

Qualitative data was collected by local research assistants by means of in-depth case studies with migrant and non-migrant women from Mumbai and the surrounding rural areas. The aim of the case studies is to compare service utilisation between migrant and non-migrant populations, and hence, the collection of retrospective data permits the comparisons of service utilisation both before and after migration and will help to identify any characteristics suggestive of selectivity of the migrant population. The gathering of qualitative information requires a less structured format allowing the respondents greater freedom to express personal attitudes, beliefs, behaviours and experiences. Whilst quantitative analysis allows the identification of relationships between factors associated with the uptake of ante-natal care, it does not allow the identification of the mechanisms and decision making behaviour that have influenced an individual's decision to utilise services. Chapter 6 showed that there are disparities in uptake of maternal health care services among those living in urban areas (urban non-migrants and rural-urban migrants). Hence, it would be of particular interest to this research to be able to identify the factors operating within urban areas which may lead to the differential uptake of services between migrants and non-migrants. The use of qualitative methodologies is best suited to provide such information.

A case study is a method of exploring and analysing the life of a social unit, be that unit a person, a family, an institution or a whole community (Bhadwaj 1989). The method emphasises the importance of detailing the total context of the unit under observation, and the combination of factors that may influence behaviour, the description of the process or sequence of events in which behaviour occurs, and the study of individual behaviour in relation to the cultural environment (Shaw and Clifford 1971). The qualitative nature of this methodology allows the motivating factors behind individual behaviour to be identified, data that cannot be provided by the INFHS. The in-depth nature of the case study method allows the identification of inter-relationships between causal factors, whilst maintaining the unitary character of the social unit being observed. Hence, the use of the case-study method will provide an opportunity to explore the factors influencing both migration and the utilisation of maternal health services.

Three groups of respondents were interviewed: rural-urban migrants, rural non-migrants, and urban non-migrants, to provide data for the origin, the destination and the migratory group. For the purpose of this research a migrant is defined as a woman who has moved from a rural area within Maharashtra to Mumbai in the ten years prior to the study. It was decided to restrict the study to intra-state rural-urban migrants due to potential problems in collecting data from rural origins. Mumbai attracts rural migrants from many states, and, given the large socio-economic differentials between states, migrants to Mumbai come from a range of socio-economic backgrounds. Thus, the inclusion of migrants from states other than Maharashtra would result in the need to travel to those states to collect data that can accurately reflect their rural origin. By restricting the study to intra-state migration this limits the collection of rural data to rural areas in Maharashtra, maintaining the research within time and monetary constraints.

7.6 Selection of Respondents

Due to the intensive nature of this method of data collection, a relatively small number of respondents were selected. Thirty in-depth interviews were conducted, stratified according to migration status: rural-urban migrants (n=10), urban non-migrants (n=10), and rural non-migrants (n=10). The target population for the research were women with two children under the age of 10, one of which should be aged under 5, to allow sufficient information to be collected on the use of maternal health care during pregnancy, and child health care during the early childhood years. The omission of currently pregnant women allows a comparison of pregnancy experiences to be made without the complications of surveying women at different stages of pregnancy.

Respondents were recruited using a "snowball" technique, a method most suited to reaching specific target populations and members of marginal groups (Singh 1991). During the period of research the national elections were underway in India, and suggested policies aimed at reducing the in-flow of migrants to Mumbai had acted to create tension between migrant and non-migrant populations. As a result, it proved difficult to identify respondents who would admit to have recently migrated to the city. Hence, migrants were treated as a marginal group and the snowballing method was most appropriate. In snowball sampling, a small number of respondents are identified and are asked to identify others with similar characteristics to themselves (in this case the characteristic of interest was migration status), such that the sample "snowballs" from the initial respondents to the complete sample size. This method of sampling was also applied to the non-migrant groups, in order to provide consistency in respondent recruitment. This form of sampling is not random, and thus may involve some element of bias, with the recruitment of respondents dependent upon their identification by others with similar characteristics. Hence, this technique may exclude the most recent migrants who have not yet established links in their new community. However, there were no sampling frames of migrants to Mumbai available to allow a random sample to be collected, and snowballing proved to be the most effective way of reaching the migrant population.

Respondents were initially identified through the *Seth* and Ramakrishna organisations, who were able to use lists of those attending the family planning and child health clinics to identify potential respondents. Health workers had knowledge of the local population and were consulted to assist in locating those who had recently moved to the area. After identifying a small number of respondents, the snowball process was used to identify other potential respondents.

7.7 Question Route

Data was collected via a semi-structured questionnaire, consisting of open and closed questions. The use of open questions allowed the respondent to express views and attitudes relating to the topic under investigation. The questionnaire was divided into seven sections. A copy of the questionnaire can be found in Appendix 6.1.

Demographic Characteristics: This section recorded the demographic background of the respondent and all other people usually resident in her household. Caste, religion, education and employment were noted.

Migration History: This section recorded a full migration history for the ten years prior to the study. Questions relating to reasons for migration, knowledge of destination, attitudes towards the city, and decision making behaviour prior to and post migration were included in this section. This section was asked only to rural-urban migrants.

Socio-Economic Status of the Household: This section consisted of closed questions recording the socio-economic status and environmental conditions of the respondents household. Questions relating to the structure of the house, the facilities available and material possessions owned by the household were included.

Pregnancy and Child birth: Pregnancy histories were recorded for each pregnancy experienced in the ten years prior to the study, detailing the survival status of the child, cause of death (if applicable), and place of delivery. For each pregnancy the care sought was recorded, including the frequency of visits, the source of care, and the receiving of preventative medicines. This section included open questions relating to the reasons behind the respondents pattern of health care utilisation, and for migrants, the differences they noted between health care in their present and previous places of residence.

Knowledge of Services: The respondent was asked which services were used for her own health needs and those of her family. The reasons behind using these services were recorded, and knowledge of other services in the local area was investigated.

Child Health: This section recorded the services used specifically for the health needs of children in the family, and vaccination histories were taken for each of the children. Again, the reasons behind the use of these services were recorded.

Female Autonomy: Questions relating to the decision making behaviour within the household were asked in order to determine the extent to which the respondent was involved in deciding to utilise health services. This section also included questions on female employment and decision making behaviour in relation to family planning.

7.8 Data Collection

The case studies were conducted by local research assistants recruited through the International Institute for Population Sciences, Mumbai. Interviews were conducted in Marathi, the state language of Maharashtra, and were later translated into English by the research assistants. Two interviewers were present at each interview, one to conduct the interview whilst the second recorded the responses. Responses were recorded verbatim onto pre-prepared questionnaires. It was decided that the use of tape-recorders to record the interviews could act to alienate the respondents, and the amount of background noise present in many interview situations would diminish the quality of recording. It was intended to interview women in the absence of other members of the household, as it was felt that their presence may influence the responses given by respondents.

7.9 Results

This section presents the results of the qualitative research, although only two sections of the data collected are reported. Two central themes of this research are rural-urban migration and the utilisation of maternal health care services, and the consequences that these have for survival in the under-two age group. Thus, the data collected on the reasons behind migration, the development of social networks, and the assimilation of the migrant into urban society are reported in order to provide a wider view of the process of rural-urban migration than is available in the INFHS (1992) data. In addition, the data on the utilisation of maternal health care services are reported in order to provide information on the quality of services used and the reasons behind the services patterns adopted. This data will also allow a comparison of the health service experiences of rural-urban and non-migrant groups. In order to preserve the anonymity of the respondents a reference system has been developed for the reporting of the results. Quotations are proceeded by a code, either *RU*, *UN* or *RN* to identify migration status (rural-urban migrant, urban non-migrant, or rural non-migrant), and a number to represent the interview. For example, *RU1* refers to the interview conducted with rural-urban migrant number one.

7.9.1 The Process of Rural-urban Migration

This section presents the results of the sections of the interviews which related to the process of rural-urban migration, examining the distances and costs involved in migration, and the changes in household formation that occur as a result of migration. In total ten migrants were interviewed, all of which had migrated to Mumbai from a rural area within Maharashtra in the ten years prior to the interview. The duration of residence in Mumbai ranged from 3 to 10 years, such that migrants who had experienced differing periods of adjustment to urban society were interviewed. It proved difficult to find very recent migrants to interview. This may be due to the sampling technique used, snowballing requires respondents to identify others with similar characteristics and recent migrants may not have developed the social networks that allow them to be integrated into migrant communities. Hence, they are not identified by other respondents.

Table 7.1 presents a summary of the timing, distances, and costs of migration for the ten migrants interviewed. Migration between a rural and an urban area involves costs, in the form of money needed for transport and to establish the migrants in the new urban area (payment of rent etc). Respondents reported that these costs were an important aspect of the decision to migrate, and that migration was often delayed until enough money had been saved to fund the move. Sekhar (1993) reports that rural-urban migration in developing societies is often a survival strategy against decreasing productivity in rural areas, in which migrants move to urban areas in order to seek employment. However, previous studies have suggested that the very poorest members of rural society do not migrate, as they do not have the means to fund the migration (Rao 1986; Connell 1976). The results of the interviews suggest that migration to an urban area requires the accumulation of enough capital to fund the move, and the respondents reported a range of ways in which such costs were met. The most frequently reported method was the borrowing of money from other family members (6/10 respondents), with respondents reporting that this lead to the creation of a debt even before they had established themselves in employment in the urban area. Three respondents reported selling their possessions, in the form of land or jewellery, in the rural areas in order to acquire the money needed to pay for the migration costs. These results suggest that the migration between rural and urban areas is in response to poor economic conditions in rural areas, such that respondents were willing to acquire debt or sell personal possessions in order to move to an urban area. Migrants reported making only one move in ten years between a rural and urban area, indicating the importance of this event, and the substantial costs that such a move entails.

Table 7.1: Migration information from rural-urban migrants in Siv Sakti Nagar

Respondent	Duration of residence in Mumbai	Method of paying for migration	Distance migrated	Number of moves made in past 10 years
One	9 years	Borrowed money from family	17 hours by state transport	one
Two	8 years	Sold possessions and borrowed from family	500 km	one
Three	10 years	Pawned jewellery to pay for migration	130km	one
Four	6 years	Father-in-law paid for migration	12 hours by state transport	one
Five	8 years	Sold land in rural area	11 hours by state transport	one
Six	4 years	Husband borrowed money for migration	2 days travel by state transport	one
Seven	3 years	Sister-in-law's family paid for migration	18 hours by state transport	one
Eight	10 years	Husband borrowed money for migration	15 hours by state transport	one
Nine	5 years	Borrowed money from brother-in-law	12 hours by state transport	one
Ten	6 years	Sold possessions and borrowed money from family	12 hours by state transport	one

Migrants reported travelling a range of distances to reach Mumbai, with most distances reported in terms of the amount of travelling time the journey required. All migrants interviewed had travelled to Mumbai by state transport, which refers to the public buses which operate throughout Maharashtra. Migrants reported that state transport provided the most economical method of movement between rural and urban areas, again indicating the importance of the costs in the decision to migrate. The range of distances travelled to reach Mumbai, with migrants travelling for up to two days by bus or covering 500km, highlights the strong attraction that Mumbai holds for rural migrants. Mehta (1990) reports that the spatial variations in India's economic development have influenced migration patterns, with migration focused on the major economic centres of Mumbai, Madras, Calcutta, and Delhi. Large cities are often associated with an increase in economic opportunities, which acts as a pull factor for rural out-migrants (Todaro 1976). Hence, the interviews suggest that rural out-migrants are willing to travel long distances and incur large costs in order to resettle in Mumbai.

During the interviews migrants were asked to report the order in which each of the family members had migrated. Two distinct patterns emerged from the interviews. Seven respondents reported that their husbands had moved to Mumbai before them, with the husbands migrating between one and four years ahead of their wives. In contrast, two respondents reported that they had moved to Mumbai together with their husbands and children. The remaining respondent migrated to Mumbai in order to get married. Hence, the practice of the husband migrating prior to his wife emerged as the predominant migration pattern. Previous studies have suggested that this practice allows a sense of familial security to be maintained in rural areas, and allows the male to establish employment and a home for his family in the urban area (Rowe 1973).

The respondents who reported that their husbands had migrated before them reported different strategies for finding employment in the urban area than those who migrated as whole families. Both respondents who migrated with their husbands reported that they had already arranged employment in Mumbai through a relative. Thus, the presence of pre-arranged employment would appear to reduce the need for the husband to migrate ahead of his family in order to find work, and allowed both families interviewed to migrate as whole units.

"My sister-in-law asked my husband to come here for employment, since they own vehicles and needed somebody to drive for them" RU8

"My husband and myself came here to work on the construction sites, and my mother-in-law had a job as a housemaid" RU3

However, the seven respondents who reported that their husbands had migrated before them all suggested that this pattern of migration had been a strategy to find employment in Mumbai. These women suggested that the decision for their husband to migrate was based on the need to find employment away from the rural area, and that they had followed their husbands to Mumbai once employment had been secured. This suggests that the husband-first migration patterns observed in earlier studies (Rowe 1973) are still in operation, with the prospect of employment in Mumbai acting to provide the pull factor for migration away from rural areas.

"My husband came here to find work because we had debts" RU6

"Somebody told my husband that you can get a lot of money from employment here, so he decided to move" RU10

"My husband came here for employment, and to live with his elder brother, and to find a home for us to live in" RU9

Respondents reported that maintaining links with their rural origins were an important aspect of the migration process. All ten migrants interviewed reported that they still had members of their husband's family living in the rural area from which they had migrated. In addition, all respondents said that they returned to their rural origins at least once per year. The most frequently citied reason for returning to the rural area was to visit relatives (8/10 respondents). Two respondents said that they owned land in their rural origin, which was tended by their relatives, and that they returned home once per year to help with the cropping of the land. This suggests that rural-urban migration does not lead to the dissolution of links with the rural origin, indicating that the familial influences on the use of health care present in rural areas may still be in operation after migration has occurred.

The process of rural-urban migration appears to lead to a change in household formation patterns, with evidence of the movement from extended families in rural areas to nuclear families in the new urban environment. All migrants interviewed reported that they had lived with their husbands family in an extended household prior to migration. However, once the husband had migrated, and the wife had eventually followed, nuclear families were formed in urban areas. There also emerged an intermediate stage in this process, four migrants reported that they lived with relatives in the urban area upon arrival until they could afford to establish their own home. Thus, there is evidence of a transferal from one extended family in the rural area to stem-families in the urban area, before the development of nuclear households takes place:

"My husband's brother found him a job, and we lived with him until we found a house" RU8

"We stayed with my sister-in-law for six months as we did not yet have a home" RU9

Literature suggests that the familial power structures and decision making processes associated with extended and nuclear families have differing consequences for the utilisation of health services and female autonomy (Griffiths 1998; Dyson and Moore 1983; D'Souza 1974). In extended households the presence of older family members may act to influence the health seeking behaviour of younger members, a process particularly apparent in the relationship between the mother-in-law and her new daughter-in-law (Griffiths 1998; Dyson and Moore 1983). The views of the older member of the household regarding the use of health services may thus decide the services utilised by other family members, such that traditional views on the use of formal services may dominate. In contrast, D'Souza (1974) suggests that the absence of such power structures in nuclear families creates greater female autonomy, with the freeing of young mothers to make their own health care decisions. However, nuclear families do not provide the social security system available in extended families, and may thus lack the presence of advice and support from other family members (Chekki 1974).

The change from extended to nuclear families with rural-urban migration suggested in the interviews may thus have consequences for female autonomy and the use of maternal health care services. Migrants reported leaving behind their husbands families to establish new households in Mumbai, suggesting a freeing from the familial power structures that prevail in rural areas and increased individual power in health care decision making in urban areas. This process may explain the migration differentials observed in the utilisation of maternal health in the INFHS (1992) data, in which the greatest difference was apparent between rural-urban migrants and rural non-migrants. The primary reason citied in the interviews for migration was to increase economic opportunities. However, it would appear that an indirect effect of migration may be a shift in the decision making power within a household, a result of the changes in household formation patterns.

The respondents reported that the decision to migrate to Mumbai was usually taken by the husband or another male member of the household. In six of the interviews the husband or father-in-law was cited as the decision maker in the migration process. In each of the cases where the decision was made by the husband or father-in-law the woman reported that she was in agreement with the decision to migrate. The remaining four respondents said that the decision to migrate had been made jointly between husband and wife. The main reason citied for migrating was to improve the families economic prospects. Thus, it appears that there are two types of economic decision making patterns, those in which the male household members make the decision, and those in which the decision involves inputs from both husband and wife.

The Indian National Family Health Survey (1992) contains limited information on migration, with only migration status available. The qualitative work presented in this section provides more detail on the exact processes involved in rural-urban migration, although it must be remembered that these results refer only to a small number of migrants in Mumbai, and are not necessarily transferable to all rural-urban migrants in India. The results suggest that rural-urban migration is an economic strategy, with the prospect of employment in Mumbai providing the primary pull factor. The attraction of employment in Mumbai appears to draw migrants from long distances within Maharashtra, and involves considerable costs, which may act to create debts with other family members. There are two distinct processes of migration in operation. The first involves the migration of whole family units, which are characterised by the presence of pre-arranged employment in the urban destination. The second involves the migration of the husband followed by his wife and family once employment has been secured. Both of these processes lead to a change in household formations, such that migration not only leads to the exposure of a new urban environment, but also has the potential to change familial power structures and decision making.

7.9.2 Reasons for Migration

This section examines the reasons for the decision to migrate between rural areas and Mumbai, in order to explore the motivational factors behind migration. The most frequently reported reason for migrating from the rural areas to Mumbai was in order to find employment. Eight of the migrants interviewed stated that the prospect of employment had attracted them to Mumbai, whilst the lack of employment opportunities in rural areas had acted as a push factor.

"We came here to find employment and earn money, here you can earn hard cash" RU1

"Here there is easy employment, there is not much trouble in finding work" RU4

"I knew nothing about this place, but we had to come here, we had no money and no property in our rural place. Here you can find work and earn money" RU10

In addition, migrants also reported that the economic conditions in their rural origins had been a major influence on their decision to migrate. Respondents suggested that the migration to Mumbai was a response not only to the lack of employment in rural areas, but also the low wages and lack of cultivatable land, which had created economic conditions which were not able to support their family's needs:

"There are not many benefits from working in the fields in our native place, here we have enough food to feed everybody, and we do not have to work in the fields for ten rupees a day" RU9

"If there was some land in the rural place it would have been beneficial for us, but that was not the case. Here we have our own house, my husband has employment, and there is electricity. Life is much better for us and our children here" RU10

The reasons reported by the migrants indicate that migration is influenced by both push factors in the rural origin and pull factors in the urban destination. Migration appears to be the product of the economic conditions prevalent in rural areas which encourage urbanward migration, with the prospect of employment in Mumbai offering a potential solution to rural poverty. The cost-benefit approach to migration theory, as described in Chapter 3, suggests that rural-urban migration will occur if the perceived benefits of the urban pull factors are greater than the actual costs of migration plus the potential benefits of non-migration (Sjaastad 1972; Todaro 1976). It is hypothesised that the decision to migrate is an investment making decision involving costs and returns distributed over time, and that potential migrants consider both their present rural situation and the opportunities available in urban destinations. The results of the interviews suggest that rural migrants to Mumbai are adopting this cost-benefit approach, with the poor economic conditions in rural areas and the perception of increased opportunities in urban areas resulting in the decision to migrate.

The perception of the urban area as offering increased employment opportunities implies that migrants had prior knowledge of Mumbai before migration occurred. The respondents stated that their decision to migrate had been influenced by information passed to them by relatives and previous migrants. Five respondents had relatives in Mumbai who told them of the potential for employment in the city, whilst two further respondents had family members who had visited the city. One respondent stated that their decision to migrate was influenced by their knowledge of other migrants who had moved to Mumbai and had found employment:

"The life here is very fast and there are lots of jobs available. My father-in-law had visited here many times, and he told us of the jobs that were available" RU5

"We knew of other villagers who had moved here and had found work" RU3

The cost-benefit approach to explaining rural-urban migration assumes that potential migrants have some knowledge of the potential economic and social benefits that may be gained by migrating to an urban area. The interviews suggest that such information is transferred to potential migrants through relatives who already live in Mumbai, and those who have previously visited the city. Ross and Werner (1997) report that migrants are continuously associated with their rural origins, through their return visits and the cross-flow of remittances and information. The interviews showed that all migrants made at least one return visit to their rural origins per year. This may in turn lead to the transfer of knowledge from migrants to those in the rural areas who are considering migration, and may add to the migrant's perception of the urban environment.

7.9.3 Assimilation into the Urban Environment

Successful adaptation into the urban environment depends not only on the behaviour and social mobility of the migrant, but also the receptivity of the host urban society (Brockerhoff 1994). Previous studies of migration behaviour have suggested that knowledge of the destination and the presence of familiar social networks are instrumental in the assimilation of the migrant into the new urban environment (Abu-loghod 1966). This section examines the methods through which migrants integrate into Mumbai, exploring the knowledge of Mumbai that the migrants reported they had prior to migration, and the help they received from other people when they arrived in the city. The problems the migrants experienced upon arrival in Mumbai are also reviewed, in order to establish the success of their transition to urban society.

Migrants reported having little knowledge of Mumbai before they migrated, stating that they only had expectations of employment rather than firm facts about life in the city. This indicates that employment was the primary objective for the migrants interviewed, they were willing to migrate to gain work with little knowledge of what to expect upon arrival:

"I only knew that Mumbai was a big city, and that you can earn money, hard cash. Mumbai is a big city, everyone knows there are opportunities here" RU6

"We came here by state transport until we reached the thana, and then we walked from there. We wanted to work on the construction sites, and did not know what would happen when we arrived" RU3

Three migrants reported that they had some knowledge of Mumbai before they migrated, consisting of information that had been passed to them by relatives living in the city. However, the respondents suggested that their knowledge of Mumbai was vague prior to migration, and that it consisted predominantly of descriptions of the merits of city life rather than factual information. All migrants were asked if they had been offered any advice on what to expect from migration prior to the move, and no respondent reported receiving such advice.

"I had attractive images of city life that my sister-in-law had told me" RU4

"I thought that Mumbai would be full of big buildings, and a good style of living, just like in the films" RU1

Five respondents reported that they had received help from relatives when they first arrived in the city. This help included providing temporary accommodation and assistance in finding employment. Abu-loghod (1966) notes that the presence of social networks are an important aspect of a migrant's transition into urban society, as they allow the migrant to access information on life in the new urban area. The results suggest that such social networks are in operation in Mumbai, with migrants reporting their reliance upon other family members living in the city for assistance with finding homes and employment. The presence of social networks also proved to be influential in the decision to migrate. Migrants reported that the information given to them by relatives living in the city and the availability of assistance from relatives had encouraged them to move from rural areas. Thus, although migrants had little knowledge of Mumbai prior to migration, the respondents suggested that social networks, in the form of relatives, were available to aid their move into the city:

"My brother-in-law was helpful, he helped us to find work and a place to live" RU4

"My relatives helped my husband find a house for us when we first arrived here" RU10

"We came here to live with my brother-in-law, he promised us work, so we came" RU5

The interviews suggest that the process of migration to Mumbai is characterised by a perception of the city as providing employment opportunities, and such information is passed to potential migrants by relatives in the city and previous migrants. Migrants appear to move to Mumbai equipped with little knowledge of life in the city, although the presence of social networks allows them to establish homes and employment through assistance from relatives. Studies of urban anthropology suggest that migrant populations are inherently cohesive, they cluster together within urban enclaves to form distinct populations within the urban environment. Five migrants reported that they lived with relatives in Mumbai when they first arrived in the city, suggesting that they are migrating to areas in which they already have familial contacts. Hence, both the decision to migrate and the location of the migrant in the new urban destination appears to be influenced by the presence of relatives and other migrants already living in Mumbai.

Migrants were asked to report any problems they had encountered upon their arrival in Mumbai. The main problems reported involved the differences between the lifestyles experienced in rural and urban areas. Respondents reported that in moving to Mumbai they left behind the rural social support systems offered by their families and other villagers. Migration to Mumbai involves the transition from small rural communities to a large city, and respondents reported that they had moved from communities in which they knew many people, to an urban area in which they found themselves living among strangers:

"Here we work on the sites with strangers, every time at a new site new people come. In the village people knew each other and helped each other " RU6

"For children and family it is good to be in the village, and for you to have your own people around, they are always helpful. Here nobody knows anyone else" RU5

The interviews show that in migrating there is a transition from extended to nuclear families, and the problems reported by migrants suggest that this is associated with a loss in familial support. Migrants reported that in rural areas the presence of other family members offered a valuable source of advice and support. However, migrants stated that this support was not available in their urban destination once they had moved away from the relatives that had provided accommodation on their arrival in the city. As a result migrants reported feeling isolated and lonely in Mumbai, although they stated that these feelings were only present during their early months in the city, suggesting that migrants overcome the initial problems of assimilation:

"We had no major problems, although I missed our relatives, but that passed after about five or six months" RU5

"We knew that we had to move away from our own people and our village, we were sad and lonely after our arrival" RU6

Migrants also reported practical problems encountered upon arrival in Mumbai. These problems included differences in the methods of food preparation between rural and urban areas, such that migrants had initial problems in finding the correct materials to cook with. Also, two respondents reported difficulties in accessing basic resources such as water. Neither of these respondents had relatives living in Mumbai, suggesting that their lack of social networks in the city resulted in a lack of information on the accessing of basic resources:

"The cooking materials used here are different to those in our rural place. When we first arrived here I found it difficult to prepare food" RU3

"When we arrived we had difficulty in getting water. For a while we didn't feel like living here, there were too many problems that made it difficult to live" RU8

The interviews highlight several important aspects of the process of migration assimilation into the urban environment. The migrants interviewed displayed very little knowledge of Mumbai prior to migration, and the knowledge reported consisted primarily of perceptions of the opportunities available in the city. However, the presence of relatives in the city provided a source of accommodation and information, which appears to have aided the transition into the new environment. The problems encountered on arrival in the city were most apparent for those with no relatives living in Mumbai, indicating the importance of social networks in allowing migrants to adapt to urban life.

7.9.4 Advantages of Migration to Mumbai

This section examines the ways in which the migrants feel they have benefited from their migration to Mumbai, exploring both the reported economic and social advantages of urban life. The main reason cited for migrating to Mumbai was to find work, and the opportunities for employment were reported as the main benefit of migration. In addition, migrants reported that employment in Mumbai had improved their economic position relative to their rural origins:

"Now we have our own home and a better economic position, we have money now" RU3

"Here there is money and employment, we own a house, and our children go to school" RU8

"We have repaid the debts we had in rural areas through our work" RU6

Migrants stated that the move to Mumbai had resulted in them finding employment in different types of work to that available in rural areas, and that the work available in the city provided them with a much higher standard of living. Respondents suggested that in their rural areas their work in agriculture had paid low wages, and had involved long working hours for low wages:

"Here the money is given according to the work done, but in our rural place it was more work and less money" RU9

"When work is available here it is good, and there may be a break for only a day or two. In our village there was no work available" RU10

"Here in the city I have a better life, a good home, and I don't have to work in the fields" RU2

Migrants reported that employment in Mumbai provided them with the opportunity to establish their own home, and two respondents stated that their wages had been used to purchase land in rural areas. This suggests that migrants are maintaining their links with their rural origins not just through regular visits, but also the purchasing of land that can be tended by relatives remaining in rural areas. Rowe (1973) suggests that the maintaining of agricultural land in rural areas by urban migrants acts as a form of financial security, enabling the remaining family members to cultivate the land and providing the migrants with a source of income if they should return to their origin.

"There has to be advantages as life is different here. There are no disadvantages. We have money now, we have bought land in our rural place for our family to tend" RU4

The interviews suggest that there are other non-economic benefits of migration to Mumbai. Respondents reported that migration to Mumbai had increased the opportunities for education for their children, and that in their rural origins such educational opportunities had been scarce:

"The children have been admitted to school early, in the village they do not go until they are at least six years old" RU5

"Since we have moved here the children have been able to go to school" RU9

Therefore, although the main motivation behind migration was to find employment, the move to Mumbai appears to have increased opportunities for other family members. The respondents also reported that there was generally more information regarding health services and educational opportunities available in Mumbai than had been present in their rural origins. Six respondents stated that they had more information on the availability of health services than they had prior to migration. The major source of this new information was cited as relatives who were already living in Mumbai, highlighting the importance of social networks not only as a provider of temporary accommodation, but also as a source of information on the health facilities available.

"Here we are more informed than the women in the village. My sister-in-law took me to find the health services." RU1

"We have more information here on health than in our rural place" RU5

Migrants reported a very positive attitude to their new urban environment, with all respondents stating that they felt the decision to move to Mumbai had offered them greater economic opportunities. The problems encountered on initial arrival in Mumbai were primarily feelings of isolation and loneliness, although migrants reported that these feelings lessened with duration in the city. The interviews suggest that for these ten migrants the move to Mumbai has resulted in greater economic opportunities than were available in the rural areas, with each of the migrants reporting that their husbands had found employment in Mumbai. Their primary motivation for migration was to seek employment for the husband, and thus their success in finding work may have resulted in their positive attitudes to their new urban environment. However, only ten migrants were interviewed, and different motivations and experiences of migration may have been found by interviewing other migrants. This study interviewed migrants and non-migrants in Mumbai and non-migrants in the surrounding rural areas. Thus, the study did not include those migrants who returned to their rural origins. These returning migrants may be those who did not fulfill their aim of finding employment in Mumbai, and may thus have a more negative view of life in the city.

7.9.5 Utilisation of Prenatal Care Services

The data in the National Family Health Survey (1992) relating to the use of maternal health care is limited. The survey recorded only whether or not the respondent received antenatal care, or tetanus toxoid and iron folic acid tablets during pregnancy, and the number of months pregnant at which the respondent first sought care. Although this data provides an indication of the levels of utilisation of health services, it cannot provide information on the quality of services used or the motivation behind the decision to use, or indeed not to use, maternal health care services. This section examines the utilisation of prenatal care services among rural-urban migrants and urban and rural non-migrants, detailing the patterns of service utilisation reported in the interviews. The respondents were asked the reasons behind their decision to use or not use prenatal care, and these reasons are examined in order to explore the factors influencing service use, and the differing motivational factors between migrant and non-migrant groups.

Prenatal care utilisation among rural non-migrants

Two of the ten women interviewed in the Sikhwai village reported receiving antenatal care during their last pregnancy. One of these women had made one visit during the eighth month of pregnancy, whilst the second woman had made two visits and was unsure of the timing of her first antenatal care visit. In the Sikhwai village the only health care available is provided through a charitable organisation that operates one day per week. The two women who reported that they had received prenatal care during their last pregnancy both stated that the advice of a health worker had been instrumental in their decision to seek care during pregnancy. One of these women reported:

"I went to the doctor at Madvi as he asked me to go now that it was my third child, and that I should go monthly. For the first two children it was not possible to go" RN1

This respondent received prenatal care as a direct result of a doctor working for the charitable organisation, which provides health services in the village, visiting her house and asking her to attend prenatal care checkups. However, the respondent only sought prenatal care once during the eighth month of her pregnancy, indicating that although the advice of health care workers is followed, there may be other constraints on the woman's ability to seek antenatal care. The second respondent who reported receiving antenatal care in the Sikhwai village did so on the advice of a health worker, although the respondent appeared unaware of the health benefits associated with prenatal care. This suggests that although prenatal care may be encouraged in this village, the resources available for the charitable health service limit the extent to which they can provide full health care information to pregnant women:

"I went for antenatal care and ate the tablets the health worker gave me. But I don't know what the benefits of these could be" RN8

Two main reasons emerged from the interviews in the Sikhwai village to explain the low levels of prenatal care utilisation: the distance needed to travel to health services and the perception that prenatal care would not influence the health status of the mother or child. The charity providing health care services in Sakhwai only operates one day a week, and residents have to travel over half-an-hour by vehicle to reach alternative services in Madvi. The effect of this distance on the decision to seek prenatal care became apparent during the interviews:

"We would only go for antenatal care if there was a problem, then we would go to Madvi, that is very far off" RN2

"It is too far off to go for antenatal care, we don't have a hospital in our village" RN3

"I don't know what use it (antenatal care) *would be. Madvi hospital is too far away, who has the time to go ?" RN8*

"Since I was in Vashi during the first two pregnancies I attended antenatal care as the clinic was nearby my place of work. After that I left work and came here, and the hospital is too far away to use the services" RN6

The latter quote shows how even women who had previously used prenatal care, and thus may be said to have a propensity to continue using such care in future pregnancies, were discouraged from seeking antenatal care due to the distances involved in reaching the hospital.

Another reason highlighted for the non-use of prenatal care was the belief that such care was not necessary for monitoring the health of women or their unborn child, with non-users stating that they did not feel that it could be beneficial to them. This suggests a lack of knowledge of the health care benefits of prenatal care in the village, which may be attributed to the scarcity of health services and the lack of resources available to disseminate knowledge:

"I never went to the antenatal care clinic as I had no problems" RN2

"What difference could it make ? One days check-up does not make any difference to me" RN3

"It is not necessary to take any care as it will all happen naturally" RN4

"My mother-in-law looks after me, and that is all I need" RN7

These quotes illustrate how prenatal care is viewed as a curative rather than a preventative measure, and that unless any obvious problems occur during pregnancy prenatal care will not be sought. There is evidence to suggest that women in this village are relying upon more traditional forms of health care, received from other family members. This highlights the need to inform women of the potential health benefits of the monitoring of pregnancy and the receiving of tetanus toxoid and iron folic acid tablets from qualified health professionals.

In addition to the problems of distance and apathy towards health care utilisation, the costs that may be incurred in seeking prenatal care were also highlighted as being a barrier to seeking such health services. The quotes listed below suggest that there exist a number of women who do recognise the need for prenatal care, yet are prevented from receiving such care due to the costs involved in travelling to Madvi to seek health care. The charitable organisation in the village provides health care on a donation basis, in which recipients are requested to provide a small donation if possible in return for health care. The interviews suggested that although this only involved a small amount of money, this too could act as a barrier to women seeking preventative health care:

"It was all normal and I had no money to seek any help during pregnancy" RN10

"I didn't have money, otherwise I would have gone (to antenatal care)*" RN5*

"It is good to go to the doctor during pregnancy, but if there is no money we can't go" RN9

The interviews with rural non-migrant women suggest that the low levels of prenatal care utilisation are due to the limited resources of the charitable organisation providing health care and the lack of a nearby alternative source of health care. The problems of distance to services are exacerbated by a prevailing sense of apathy towards the importance of prenatal care and a lack of health awareness information available in the village.

Prenatal care among urban non-migrants

Respondents interviewed in Siv Sakti Nagar displayed a high uptake of antenatal care services. Of the ten women interviewed only two women reported not receiving any form of antenatal care during their last pregnancy. All women who reported receiving antenatal care also reported receiving the necessary two doses of tetanus toxoid injections and iron folic acid tablets. Despite the high levels of antenatal care utilisation, there exist differences in the timing and frequency of antenatal care among urban non-migrant women. The interviews suggest that there are two distinct groups of urban antenatal care users: those who seek care early in the pregnancy and continue to make regular visits, and those who wait until late in the second trimester of pregnancy to seek care. Six women received antenatal care during the first two trimesters of pregnancy, whilst two women sought care during the final trimester. In general, those receiving care in the first two trimesters of pregnancy made a total of three or four antenatal care visits during their pregnancy, whilst those receiving care in the final trimester made only two or three visits. Five women reported seeking care from government sources, and three received care from private practitioners. Therefore, although the urban women displayed high levels of antenatal care utilisation, there are intra-urban differentials in the timing, frequency and type of antenatal care sought, suggesting that there exist different categories of health care users who have varying motivations for their health care behaviour. Hence, the health benefits of receiving antenatal care early in pregnancy, and frequently throughout pregnancy, are non-uniform throughout the urban non-migrant population.

All respondents receiving antenatal care reported the potential benefits that the uptake of prenatal services could have for the health of both themselves and their unborn children. This is in contrast to the rural non-migrant group in which a number of women had reported that prenatal care was not beneficial to their health. The following quotes typify those given by women receiving antenatal care in Siv Sakti Nagar:

"For the child to be delivered healthy you need to get good care" UN5

"Antenatal care gives the mother and child good health" UN2

The quotes suggest that the high levels of maternal health care use are a product of the common belief that such services are beneficial to the health of the mother and child. However, upon further probing as to the reasons why prenatal care was sought, a number of respondents (4/10) gave answers which suggested they were not fully aware of the ways in which prenatal care could benefit their health. For example, two women reported that prenatal care would prevent polio:

"Antenatal care is important as you get vaccinations to prevent diseases otherwise you might get polio" UN7

"The health worker advised us (to get antenatal care) so as not to have any troubles and to prevent polio" UN9

These responses suggest that the women were confused about the potential health benefits of antenatal care. Polio is not one of the diseases which antenatal care is targeted to prevent. Although these women were misunderstanding the potential health benefits of antenatal care, they were attending the service and hence reaping the benefits of the care. However, the above evidence suggests that there is a further need to educate women regarding the exact benefits of antenatal care for themselves and their unborn children. The latter quote introduces the importance of health officials in motivating women to attend for antenatal care. In Siv Sakti Nagar the *Seth* organisation actively encouraged local women to utilise the prenatal services they provided. There were a small number of women (3/10) who reported the importance of the health worker in persuading them to receive antenatal care. These quotes typify their responses:

"The health workers advised me to take care, it is important for the health of the mother and the child." UN1

"I went for antenatal care because of the doctor's advice" UN4

Respondents suggested that the close proximity of the government health services were an important factor in influencing their decision to receive prenatal care. However, in the rural non-migrant group the distances involved in travelling to the health services were reported as the main barrier to their utilisation. Hence, the differences in the utilisation of prenatal care services between rural and urban areas may be a product of the differing accessibility of services between the two regions:

"I use antenatal care since there are facilities available and it is good for my health." UN3

"I had gone to my native place but there were no services at all for antenatal care so I came back to this place." UN8

Only two urban non-migrant women did not receive any form of antenatal care during their last pregnancy. These women reported that pregnancy is a natural state, and medical care should only be sought if an obvious problem arises during pregnancy. This suggests that antenatal care is viewed by some women as a curative rather than preventative form of care. Improvements in the knowledge of the full potential benefits of prenatal care, including the importance of receiving tetanus toxoid vaccinations, may be important in encouraging these women to utilise ante-natal care. These quotes typify the responses given by women not attending antenatal care:

"Since there was no trouble, if there was a problem or something occurred, then there is a doctor nearby." UN10

In addition, those women who did not receive prenatal care displayed a lack of awareness as to the location of services, and were apathetic as to the importance of receiving antenatal care. For example, one had only recently moved to the area and had given birth a year after arriving. She reported that she had not known the location of antenatal care services during her pregnancy, and that she had since gained knowledge as to their location which she would use for any future pregnancies. Two respondents who did not receive antenatal care gave answers which suggested they lacked the motivation necessary to seek out prenatal care services:

"We had to go very far to get to the health services so I didn't feel very much like going" UN6

"I knew about the injections that should be taken in pregnancy, but I just didn't go and get them, it would take too much time" UN10

The interviews with urban non-migrants suggest that the majority of the respondents were aware of the importance of the protective nature of prenatal care for the health of both themselves and their unborn child. Although respondents were actively seeking prenatal care, occasionally the health care beliefs motivating this utilisation were misinformed. There is therefore a need to provide complete information to users of the service regarding the health benefits of prenatal care. There remains a small group of urban non-migrant respondents who do not receive prenatal care. These women either did not realise the potential preventative nature of prenatal care or appeared not to be concerned with their lack of service utilisation during pregnancy. In addition, the distances involved in travelling to health services proved to be a barrier for those women who did want to receive prenatal care.

Prenatal care utilisation among rural-urban migrants

The migrants reported similar patterns of prenatal care utilisation to those observed in the urban non-migrant group. Eight of the ten migrants interviewed reported using prenatal care services during their last pregnancy. All women who reported receiving antenatal care also reported receiving the necessary two doses of tetanus toxoid injections and iron and folic acid tablets. Again, differences emerged in the timing and frequency of prenatal care use, with the same two patterns apparent in the migrant group than had been observed in the urban non-migrant group. Four women reported receiving prenatal care late in their pregnancy (third trimester), whilst four women stated that they had sought care in the first or second trimester. Those receiving care in the first two trimesters of pregnancy made a total of three or four antenatal care visits during their pregnancy, whilst those receiving care in the final trimester made only two or three visits. Four women reported receiving care from government clinics, and four stated that they had received prenatal care from private practitioners. Once again, this reflects the pattern observed in the non-migrant group, in which two different sources of prenatal care were reported. Migrants and urban non-migrants were both selected from the same urban area, Siv Sakti Nagar. Hence, both migrants and urban non-migrants are exposed to the same availability of health services, which may act to explain the resemblances in the patterns of uptake. The similarities in service usage also suggest that the migrant group have assimilated into urban environment to such an extent that they have adopted the same service usage behaviour as their urban non-migrant counterparts.

The reasons reported for the utilisation of prenatal care among rural-urban migrants were similar to those expressed among the urban non-migrant group. The knowledge of the potential benefits of prenatal care for the health of the mother and child proved to be the primary influence on the decision to seek prenatal care among rural-urban migrants.

"It is important for the health of the mother and child" RU1

"The monthly checkups are very important as they tell you things about your babies health" RU4

"I knew that the vaccinations you receive were very important for my health" RU3

In contrast, rural non-migrant women had reported that prenatal care would not benefit them, with the prevailing belief that prenatal care was a curative rather than preventative measure, that would only be sought if a problem arose during pregnancy. This suggests that the attitudes towards the use of prenatal care differ between urban and rural areas, and that rural-urban migrants adopt the attitudes prevalent in their new urban environment. In addition, the difference in the perception of prenatal care between the urban and rural groups highlights the differences in service availability between the two areas. The presence of health workers in Siv Sakti Nagar was reported to influence some women to seek care. However, in the Sikhwai village the limited health services available did not include health workers, and the uptake of prenatal care was thus reliant on the woman actively seeking care herself. In total, three rural-urban migrant women reported that their decision to utilise prenatal care had been influenced by the health workers:

"The health workers advised me to attend the clinic" RU5

"I went only to get an injection, on my doctor's advice, otherwise I would not have gone" RU7

"I only went in the last pregnancy, when I was told how important the injections are" RU9

Only two rural-urban migrant women reported not using prenatal care during their last pregnancy. In the urban non-migrant group the main reasons for the non-use of prenatal care had been a sense of apathy towards service use, and the belief that prenatal care was a curative measure. Among the rural-urban migrants the reasons for the non-use of prenatal care emerged as the time and cost involved in travelling to the government hospital in Madvi to seek care. In addition, one respondent reported that prenatal care was not beneficial to her health, and that the use of health services had not been common in her rural origin, and thus she would not use services in her new urban environment:

"We have no money for the expense of a hospital. Other people have money, and they go, but we don't, so what is the point of going ? I have no time for such things" RU10

"We villagers prefer not to go to hospital. It is too difficult to go, I don't have the time. What use is it to me ?" RU8

The latter quote indicates that this respondent still perceives herself as a villager, despite having lived in Mumbai for three years. Hence, the respondents perception of herself as a villager living in her new urban environment may suggest that her patterns of service use are still influenced by the same beliefs that were in operation in her rural origins. The concerns over the time and costs involved in seeking prenatal care, and the belief that such care was not beneficial to the mother's health were all found to be reasons for the non-use of prenatal care among rural non-migrants. The presence of such beliefs among rural-urban migrants suggest that migrants may be transferring their rural attitudes towards health service use to the new urban environment. However, the non-use of prenatal care services was only found in two of the ten respondents, the majority of the migrants interviewed appear to have adopted an urban pattern of service use.

Respondents were asked to detail the sources of information used to identify the prenatal care services in Mumbai. The eight migrants who reported using prenatal care stated that relatives living in Mumbai or the health workers present in the local area had been the main source of information on health services. This suggests that there are two methods through which migrants can gain knowledge on the services available in their new environment. The presence of social networks, in the form of relatives living in Mumbai, acts as a source of information to migrants, allowing them to identify the presence of health services in the city. In addition, health workers provide a source of information on health services, encouraging women to utilise prenatal care.

However, two migrants who had used prenatal care for their last pregnancy reported that they had not used services for earlier pregnancies as they did not know that such services were available. This suggests that assimilation into the new urban environment, and hence the utilisation of the services available, is not instantaneous and that it takes time for migrants to adapt to their new environment and to gain knowledge on the services available:

"I did not know that such things existed, nobody told me" RU2

"I should have taken better care of my health, but I was not aware of the need. I did not know where to go" RU4

The two respondents quoted above both had babies within two years of arriving in Mumbai, and both reported that they had not used prenatal care during these pregnancies. They suggested that their lack of knowledge regarding both the availability and health care benefits of prenatal care had been the main reasons for their non-use of the services. However, they sought care for their last pregnancies, by which time they had been living in Mumbai for over five years, indicating that more information regarding health services is gained with duration of residence in the city.

Migrants were asked to detail the prenatal care services available in their rural origins, and to describe the general patterns of service use among their rural communities. Respondents reported that in general the use of prenatal care was low in their rural origins, and this was attributed to the lack of services within close proximity to the village. Migrants were asked to describe why prenatal care services were not utilised among their rural communities, and their responses were similar to those given in the rural non-migrant group. The distances and costs involved in travelling to the services were highlighted as the main reason for their non-use:

"The community does not use any services in general. Just in case there is an emergency we have to take out a loan to pay for the hospital expenses, it is too much money" RU4

"The distances involved are too long, there are vehicle problems, the doctors don't give good attention, and it all takes too much time" RU2

"In the native place there is no transport available to reach the services, they are too far away, and nobody has the time to go all that way" RU3

"There are no dispensaries in the village I came from, we have to travel three or four miles, and nobody has the money to go" RU7

In addition, migrants reported that in their rural communities prenatal care services were not used as such services were not perceived as being beneficial to the health of the mother or child, and that care would only be sought in an emergency. The interviews conducted with the rural non-migrants found similar results. Hence the belief that prenatal care is a curative rather than a preventative measure appears to be a characteristic of rural communities. Migrants also stated that in rural areas women's health was looked after by other female members of the household, suggesting that women are relying on more traditional forms of care provided by other family members:

"It is too far off to go for services in our rural place, women's health is looked after by the womenfolk of the household, they do not need anything else" RU6

"Some ladies in the village take tablets and injections, although I think they prefer not to be troubled" RU1

"In the rural areas we don't take any care with services, what do we know back there about such services ?" RU10

Respondents were asked to detail the differences they had observed in service availability between their rural origins and Mumbai. All migrants stated that there were more services available in Mumbai than had been available in their rural communities, with the presence of hospitals the main difference highlighted. Migrants also reported that a wider range of prenatal services were available in Mumbai:

"Here there are many big hospitals, but in my native place there was no where to go for help when you got ill" RU1

" In the city you can go to a place and have your delivery, you can get care during pregnancy and operations easily" RU3

"We came here for employment mainly, after coming here I feel there are more medical services. In the village there is no doctor at all, here we visit the doctor whenever we feel ill" RU8

The interviews suggest that migrants are moving from rural areas characterised by low service availability and the common belief that prenatal care is a curative measure, to Mumbai where the greater availability of services and the presence of social networks and health workers encourages women to seek care during pregnancy. The migrants all stated that there were large differences in the availability of services between Mumbai and their rural origins, suggesting that the high levels of service utilisation among the rural-urban migrant group are due to their move between two different health service environments. In migrating to Mumbai migrants are becoming exposed to a greater availability of services, which appears to lead to their utilisation. All migrants were able to identify the presence of prenatal care services in Siv Sakti Nagar, indicating that although they may not use the service, they do have the knowledge that such services are available. However, the interviews also suggest that for some women the knowledge of service availability is gained with experience of living in the city, and that the rural pattern of non-use may still be in operation until migrants increase their knowledge of services through family members and health workers.

Migrants were also asked to detail any traditional practices surrounding pregnancy that were performed in their rural origin, and whether they felt it was important to maintain these practices in their new urban environment. All migrants stated that the practices performed in their rural communities would not be performed in Mumbai, with respondents reporting that these practices were only important in rural areas:

"We used to do things, like promises to gods, but we don't do that here. Here the only cure is at the hospital" RU4

"Yes, in the rural areas we sacrifice goats and distribute sweets. Here we go directly to the doctor" RU7

"Here they are not important rituals, but in the village we would perform them" RU8

"It is important to carry them on in the village, they are tradition, like the sacrificing of hens to get a boy child. But they are no longer important here" RU9

Respondents stated that the traditional practices had been used in rural areas to treat ailments during pregnancy and infancy. However, they reported that in Mumbai they preferred to use the formal health services available. This indicates that migrants are moving away from traditional beliefs surrounding health, and are migrating to an urban area where the greater availability of services allow them to seek formal health care. Their preference for formal health services indicates that they recognise the health benefits that such services can offer. Basu (1990) suggests that the low levels of service utilisation in rural India are due partly to the influence of traditional ideas surrounding health, hence in moving away from rural areas migrants may be removed from the influence of these traditional beliefs. The decision not to maintain these practices in Mumbai suggests that migrants are adopting an urban lifestyle, including the utilisation of health service, and are no longer associating with traditional rural beliefs.

7.9.6 Place of Delivery

This section reports on the sections of the interviews that asked the respondents to detail the place of delivery used for their last child, and the reasons behind the choice of this place of delivery. The aim of this section is to compare the places of delivery utilised by rural-urban migrants and urban and rural non-migrants, in order to examine whether migrants adopt the urban patterns of place of delivery when they migrate to Mumbai. Migrants were asked to report the places of delivery used in their rural origins, and these will be reported in order to examine whether migrants utilise different places of delivery in their new urban environment to those in their rural origins. The places of delivery utilised by rural non-migrants are reported in order to provide a contrast to those living in urban areas (urban non-migrants and rural-urban migrants).

Places of delivery among rural-non migrants

In general, the rural area studied was characterised by a reliance upon home births, with all women interviewed in Sikhwai, near Mumbai, delivering their last child at home. Sikhwai has no formal health facilities within a half an hour vehicle ride from the village. The women in this village were therefore restricted to home births, unless they were able to make the long journey to the health facilities. Again, the availability of services with an area appears to be the major influence on service utilisation.

The perception of the potential benefits of a home delivery may act to explain the high prevalence of home births reported in the rural areas. All ten rural non-migrant women reported delivering their last child in their own homes. In the Sikhwai village all home deliveries were conducted by an untrained *dai*[1]. The experience of the *dai* in conducting deliveries emerged as a strong influence on the decision to deliver a child at home:

"She is old and experienced and takes care of all the deliveries in the village" RN2

"It is better to deliver at home as everyone is nearby and the dai takes proper care" RN5

The case studies highlighted the importance of other traditional beliefs in influencing the choice of place of delivery in rural areas. One woman suggested that the home provided an environment in which she was able to maintain her duties which was an important aspect of the traditional beliefs surrounding birthing practices in her rural community. The home was, therefore, a "safe" environment for the woman to give birth because she felt able to behave in a way which she perceived to be conducive to a less stressful delivery. The advice of elder members of the family was also important in a woman's choice of place of delivery:

"It was all normal. We believe if during delivery we keep working rather than resting the delivery will be without difficulty. It is important to work." RN7

[1] A dai is a traditional midwife, untrained in modern medicine, who conducts the births in a local area in return for a small stipend

"My mother-in-law said it was best to deliver the child at home" RN4

In Sikhwai there was further evidence to suggest that the overall prevalence of home births in the rural community was a strong influence in motivating women to continue this tradition of home births. Women interviewed in Sikhwai reported that there was a general reliance upon home births in their village, such that home births had become a cultural norm, indicating the influence of community beliefs on individual behaviour:

"Everyone in our village is born at home" RN10

"In my village all of the deliveries of children are at home" RN1

This reliance upon home births may be partly attributed to the distance to the nearest health facility. The nearest government hospital is a half an hour journey by road, hence making it impossible for a woman in labour to easily access this facility. Many of the women interviewed expressed a desire to utilise more formal health facilities for childbirth. However, the distances involved in reaching a government hospital proved an insurmountable barrier to their utilisation:

"All of my children were born at night and there is a problem with transport to the hospital, otherwise we would have gone." RN3

"When the delivery is at night we cannot go anywhere, and the hospital is very far off, by the time we reach it will be too late." RN9

" I give birth at home because the present hospital is far away and here the villagers have deliveries at home." RN6

"No, since all of them were born at night, otherwise I would prefer going to the hospital. My sister had a problem with her delivery and we took her there in a crane." RN3

This last quote highlights the problems faced in reaching formal health services from the Sikhwai village, with this respondent resorting to the use of a crane to travel to the hospital. In this case problems during labour meant that it was imperative that the respondent reached the hospital and so this unusual form of emergency transport was utilised as it was the only available vehicle in the village. For other women in this village the distances involved in travelling to the hospital result in a reliance upon home births. The location of the hospital in relation to the village not only posed a physical problem of distance, but also created an economic problem through the costs incurred in travelling to the local government hospital. Such costs may be both direct, in the money needed to pay for transport to the hospital, and indirect costs created by the woman's absence from agricultural work and domestic duties. These costs emerged as influences on the decision for women to give birth at home in Sikhwai, Mumbai:

"We did not have the money to go to the hospital, so I had to deliver the child at home" RN2

"I don't have any money otherwise I would have gone to the hospital" RN5

The rural non-migrant population studied is characterised by a reliance upon home deliveries . The prime factor influencing the decision to deliver at home appears to be the belief that the care available from a dai is superior to that offered in a formal health institution, allowing the woman to give birth in her home environment whilst maintaining important traditional beliefs. The prevalence of home births in Sikhwai, Mumbai, acted to create an environment in which home births are the cultural norm, and as such women reported that in giving birth in their own home they were merely following well established local practices. However, there is evidence from the case studies to suggest that there is an unmet need for formal health facilities for childbirth in rural areas. Among those women who reported delivering their last child at home, some reported that the distance to the nearest hospital and the costs associated with reaching this facility were obstacles to their utilisation. These women indicated that they would have used formal health facilities if they had been more accessible.

Places of delivery among urban non-migrants

Women interviewed in the urban non-migrant group reported three places used for the delivery of children: three respondents had delivered their last child in a government hospital, three had utilised a private hospital, and four had delivered their children in their own home. Thus, although the urban non-migrant group appeared homogenous in its utilisation of prenatal care, it appears that the group uses a range of places of delivery. Therefore, there is the potential for differences in the quality of delivery care to exist within the urban environment.

The interviews conducted with urban non-migrants showed that a range of health services are utilised for childbirth. The decision to give birth in each of the three places reported in the interviews (home, private hospital, and government hospital) proved to be influenced by a differing set of motivating factors. Among those women who had given birth to their last child in a private hospital, the main reason given for this decision was that private hospitals offer a safe and comfortable service:

"Since the first child had been delivered here and I felt comfortable here. It was also in the best interests of my health" UN3

"I chose to go to the private hospital because they provide a better service than the other hospitals" UN6

These quotes indicate that urban non-migrant women perceive there to be differences in the quality of childbirth services offered between private and government services, with women who had chosen to deliver in a private hospital indicating that quality of service was an important motivating factor. The use of a private hospital for childbirth obviously incurs a cost, and from the interviews it became apparent that the cost of childbirth was often the decisive factor in the decision to use either a private hospital or an alternative health institution:

"Since I could afford to go I went to the private hospital nearby, I had also had some problems during the last two deliveries" UN7

Government health services are free, and this proved to be an important factor in influencing a woman's decision to deliver her child in a government hospital. However, in order for such services to remain free they must be nearby so as to avoid incurring travelling costs.

"During the first delivery I was afraid to go to the government hospital. For the second baby my neighbour advised me to go to the government hospital, which is cheap" UN5

Four women reported delivering their last child in their own home. The interviews found that for some women prenatal care was perceived as a curative measure, and was only utilised if a problem occurred during pregnancy. A similar belief emerged among those women who had chosen to deliver their child at home. These women reported that childbirth would only take place in an institution if a problem occurred during labour:

"I delivered at home since there was no trouble, if there was a problem or something occurred then there is a doctor nearby" UN1

"It all happened at home itself. There was no problem, I delivered just after I felt the pain" UN1

"The delivery of all my children took place at home, a hospital is only used when there is a problem, otherwise if everything is ok why go to a hospital ?" UN10

"Only in an emergency would I go to a hospital, since it was all normal I preferred to deliver my children at home" UN9

Those women who reported delivering their last child in their own home had the childbirth conducted by either a relative (usually the respondents mother-in-law) or the local *dai*. Respondents reported that the experience these people had in delivering children made them feel safe and reassured during childbirth:

"The dais deliver the babies in this area, and most women prefer them to doctors" UN9

" I asked her to deliver my child because she is my mother, and she knows best" UN1

"I knew the lady who delivered my baby, she advised me to go to the doctor, but I asked her to do it, I felt safe with her" UN4

"My mother had handled the deliveries of all my five sisters and knew what to do. She is much better than the doctor" UN10

This group of women displayed a preference for home deliveries due to the perception that the care offered by a relative or the *dai* is superior to that available in a hospital. The services of a *dai* are a visible part of the local community, by utilising the services of the *dai* women are keeping childbirth in their local environment, in which they feel more comfortable than the environment offered by a hospital. The following quote typifies the responses of some women who felt uneasy about delivering in the unfamiliar hospital environment:

"I felt too shy to go to the hospital, so I had my baby here, at home" UN1

The interviews highlighted distinct intra-urban differentials in the places utilised for childbirth among urban non-migrants in Mumbai. The majority of women interviewed in Siv Sakti Nagar reported a reliance upon home deliveries, although there were some women using both government and private hospitals. The primary factors influencing the decision to give birth in a private or government hospital in an urban area are the costs associated with private health care, and the location of the services in the local community. The perception of both the uptake of prenatal care and childbirth in a formal institution as curative forms of health care influence the decision to deliver children in their own homes. These women felt reassured by the use of the traditional *dai* or a female relative for childbirth and reported feeling uneasy with the hospital environment. The results suggest that whilst the uptake of prenatal care may be almost universal in this group, the quality of intra-partum care may vary due to the difference in services used.

Places of delivery among rural-urban migrants

The previous sections showed that the rural-urban migrants interviewed displayed similar patterns of prenatal care utilisation to the urban non-migrants. However, the results of the interviews show that in terms of the places used for child delivery, the rural-urban migrant group displayed patterns similar to the rural non-migrant group. Eight of the rural-urban migrants reported delivering their last child at home, one reported that she had delivered in a private hospital, and one had used a government hospital. Again, the decision to use each of these places was influenced by a different set of factors, with a similarity in the influences on choice of place of delivery apparent between the rural-urban migrant and rural non-migrant groups.

The reasons given for choosing to deliver the child at home were similar to those reported by both rural and urban non-migrants who had delivered their children in their own home. Women reported that as childbirth is a natural state they would deliver their child at home, and that a formal health facility would only be used if a problem arose:

"There was no problem with my pregnancy, so there was no need to go to hospital. It all happened here at home" RU1

"I didn't need to go to the hospital as my delivery was easy" RU6

"Nothing was different. My mother-in-law looked after me, since it was all normal I just carried on" RU9

"I was at home when I had my baby, my mother-in-law was there, it was all easy there" RU5

Among the rural non-migrant group the home births had been conducted by the local *dai* or another female member of the family. The rural-urban migrants reported that they relied on other family members or women in the neighbourhood who they felt were experienced to deliver their child. As in both the non-migrant groups, the perception of the experience of these women was reported as offering a safe home delivery, and was a strong influence on the decision to deliver at home:

"I knew the lady who conducted my delivery very well. I asked her to deliver my child as I knew that she would do it well. She delivers lots of children in this area" RU7

"The birth was conducted at home, my mother helped, because she is my mother and she is experienced" RU5

The presence of health workers was identified as an influence on the decision to utilise prenatal care among both the rural-urban and urban non-migrant groups. However, the interviews with rural-urban migrants suggest that although the advice of health workers may have been influential in the uptake of prenatal care, the advice they offered was not important in the choice of place of delivery. For example, one respondent reported that a local doctor had suggested that she deliver her child in a hospital, however she preferred to deliver her child in her own home:

"It all took place at home, a doctor came to my house and told me to go to the hospital. But I wanted to stay here, so I had the child at home" RU8

These results suggest that migrants are maintaining the rural practice of delivering their child at home after they migrate to Mumbai, despite the advice of health workers in the city. However, home deliveries are not restricted to rural populations, the interviews also showed that home deliveries were practised among the urban non-migrant group, although to a lesser extent. Home deliveries have been associated with increased risks of neonatal and maternal mortality and morbidity (Gunasekaram 1988), and thus the training of *dai* to provide safe home deliveries or the encouraging of women to deliver in a formal health institution may be considered a high priority in maternal health policy. The presence of home deliveries in both the urban and rural study populations suggests that the reliance on home deliveries is not merely a product of differing service environments, home deliveries are still apparent in Mumbai which has government and private hospitals available.

Two rural-urban migrants reported delivering their last child in a formal health institution. One woman reported that she has used a private hospital, whilst the second respondent used a government hospital. Each of these respondents stated that these places of delivery had not been their first choice, and that they would have preferred to have delivered their child at home. However, the absence of close family members to assist with the birth and the presence of medical problems had resulted in the use of formal health facilities:

"I had problems at the end of my pregnancy and so I had to go to the private hospital. It cost us a lot of money, which we had to borrow" RU3

"I went to the government hospital as I did not have any family to help me with the delivery, my husband decided that I should go to hospital" RU2

These two quotes highlight important aspects of the respondents decision to deliver a child in their own home. Firstly, deliveries in a formal health facility will only occur if a problem arises. In addition, a home delivery requires that other family members or the local *dai* are available to assist with the delivery. The absence of social networks in the new urban environment may thus result in a woman having to deliver her child in a hospital, which may not be her first choice of place of delivery.

7.10 Discussion

The data from the Indian National Family Health Survey (1992) allows the identification of those who have migrated between a rural and urban area in the ten years prior to the survey. However, this is the only migration data available, and thus the relationship between migration and child mortality has been modelled using migration status only, and has not considered other aspects of the migration process that may have an influence on child survival prospects. The qualitative research conducted in Mumbai allowed the exploration of the process of rural-urban migration, investigating the reasons for migration and the mechanisms through which migrants adapted to their new urban environment. The results of the interviews allow the identification of processes among migrant groups which may have implications for child survival.

The process of rural-urban migration

The review of migration theory, in Chapter 3, suggested explanations for the decision to migrate between a rural and an urban area in the developing world, and the results of this chapter suggest that some elements of these migration theories may be applied to the process of rural-urban migration in Maharashtra. The interviews suggest that the principal motivation behind the decision to migrate to Mumbai is economic, with migrants reporting that the perceived availability of employment acted to attract them to the city. Lee (1996) hypothesised that rural-urban migration is a product of push and pull factors operating in the origin and destination, that act to attract migrants to the destination or repel them from their origin. In addition, it was suggested that the balance of the positive and negative factors must be great enough to overcome the natural inertia inherent in any population. Migrants reported that they were moving to Mumbai in order to find employment, with the perceived economic opportunities in the city acting as the primary pull factor. The economic conditions prevalent in the migrant's rural origins, characterised by low wages and a lack of employment opportunities, provided the push factors from rural areas. Thus, migrants were making a rational decision to migrate based on both the perceived benefits of the destination and an awareness of the conditions in the origin. The long distances which migrants reported travelling to Mumbai, and the high costs that this migration involved, indicate the strong attraction that the perceived economic conditions of the city have for migrants. Sjaastad (1962) suggests that migration between rural and urban areas is an investment making decision. The costs and debts that migrants reported were associated with their move to Mumbai indicate that migrants are accumulating debts and selling their possessions in the rural area with the expectation that employment in Mumbai would offer them a higher standard of living, hence they are making an investment decision.

Migration theory suggests that knowledge of the destination is an important influence on the decision to migrate (Bogue 1977; du Toit 1990). It is hypothesised that rural populations are not homogenous in terms of their knowledge of urban areas, and that migration is selective of those with knowledge of urban environments (Bogue 1977). However, migrants reported that they had little knowledge of their urban destination prior to their move, and that the knowledge they did have consisted primarily of perceptions of city life rather than facts about Mumbai. Thus, it appears that migration to Mumbai is precipitated not by knowledge of the city, but by expectations of the economic opportunities available. Multi-causal models of migration suggest that the rural origin and urban destination are in constant contact through the cross-flow of skills and information, and the transfer of knowledge to the rural area acts to encourage urbanward migration (Mabagunje 1970). Respondents reported that they had been told of the opportunites available in Mumbai by relatives who had visited the city and previous migrants who had made return visits to the rural areas, suggesting that the transfer of knowledge from the urban to rural areas is an influence on the decision to migrate. In addition, migrants stated that they made regular visits to their rural origins, suggesting that they may themselves act to encourage further migration through their own transfer of knowledge to their rural origins.

The cost-benefit approach to migration theory suggests that each migrant is an individual, with a background and personality that predisposes them to particular values and choices, which in turn form the basis for their decision to migrate (du Toit 1990). The interviews highlighted a variety of circumstances which had influenced the decision to migrate to Mumbai. Although the principal motivation for all migrants was to seek employment in Mumbai, migrants reported a range of economic conditions in their rural origins. Several migrants reported that they had no land in their rural origin, and thus their decision to migrate was based on the need to find a source of income in the city. In contrast, other migrants reported that they had moved to Mumbai in order to improve their income, and that their relatives were maintaining their land in their rural origins. Thus, although the migrants interviewed may all be categorised as economically motivated, they must not be considered an homogenous group. There are differences in both the conditions they experienced in their rural communities and the extent which they assimilated into their new urban environment.

Social networks and urban assimilation

Eight respondents reported that they had relatives living in Mumbai, and that the presence of other family members in the city had been influential in their decision to migrate. The social networks provided by relatives in the city were used by the migrants for assistance in establishing homes and employment in Mumbai. In addition, these social networks were highlighted as valuable sources of information on the facilities available in the city, including prenatal care services. However, two migrants reported that they did not know anyone in Mumbai prior to their migration, and these respondents were the only ones to report experiencing major problems after their arrival in the city. This suggests that among those interviewed the process of migration assimilation into the host urban society is assisted by the presence of relatives and previous migrants who provide social networks and sources of information. Those migrants without social networks reported that their transition into urban society had involved more problems than those who had the advantage of relatives in the city who could provide them with temporary accommodation and information.

The concentration of migrants in the low income and informal employment sectors creates a distinct underclass in urban societies, characterised by residence in informal housing and a lack of formal sanitation facilities (Brockerhoff 1995). In addition, urban slums in India often experience a lack of formal health facilites, with the dependence upon traditional or untrained medical practitioners (Prasad and Somayjula 1992).

Residence in these environments has obvious implications for child survival prospects. Overcrowding and informal sanitation have been highlighted as determinants of child mortality (Timaeus and Lush 1995). The multi-level logistic modelling of mortality found that those in the lower levels of the standard of living index had the highest risks of experiencing death in each of the three age groups analysed. Migration between a rural and an urban area involves the transition between two very different environments, and the environmental influences on child mortality may be greater for recent migrants who are not equipped with the knowledge of urban lifestyles. The interviews suggest that for some migrants knowledge on their new urban environment is provided through the social networks formed by family members in the city. However, other migrants who did not have access to such information reported that they experienced problems upon arrival in Mumbai. Therefore, the relationship between migration and mortality may be influenced by the presence of social networks in the city, which act as information sources and mechanisms through which to assimilate into urban society. The greatest impact of migration on mortality may thus be among those migrants who do not have access to social networks in the city.

All migrants interviewed suggested that they had benefited economically and socially by migrating to Mumbai, and that their standard of living was higher than that in their rural origins. These differences in the standards of living experienced before and after migration were not examined in the modelling of mortality as the INFHS (1992) includes only current status data on socio-economic conditions, and thus it was not possible to establish the standard of living prior to migration. However, the interviews suggest that migration involves a change in socio-economic conditions, which may in turn influence child survival prospects. Migrants reported that their husbands had found employment in Mumbai, and that they now had more money available to them than they had in their rural origins. This increase in household income results in the greater availability of resources for the purchasing of food and expenditure on health services, which may in turn increase child survival prospects through increased nutritional status and access to health care. This process may explain the differences in under-two mortality observed between rural-urban migrants and rural non-migrants in the modelling of mortality. However, the results presented here refer only to ten migrants interviewed in Mumbai, and their experiences of migration may not necessarily be indicative of the experiences of all rural-urban migrants in India. All migrants interviewed reported that they had gained employment in Mumbai, and had positive attitudes to their new urban environment. The case studies did not include those who may have returned to their rural origins after failing to find employment in the city, or those without accommodation in the city who had less success in assimilating into their new environment. It seems plausible to suggest that the impact of migration on the child survival prospects of these other types of migrants may be very different to those observed in this study.

Changes in household formation

The interviews discovered that the process of rural-urban migration is associated with a transition from extended to nuclear families. Literature suggests that extended and nuclear families are associated with differing power structures and decision making processes, which have consequences for the utilisation of health services (Griffiths 1998;

D'Souza 1974). The health care decisions in extended families are often influenced by the beliefs of older family members, whilst nuclear families result in greater female autonomy in health care decisions (Dyson and Moore 1983). However, previous studies have found no direct relationship between household formation and the risks of experiencing infant and child mortality at the individual level (Griffiths 1998). The relationship between household formation and child mortality may be an indirect effect. Nuclear families may have a greater utilisation of maternal health care services, and thus lower levels of infant mortality, than extended families (Dyson and Moore 1983). The rural-urban migrant group displayed a higher level of prenatal care utilisation than their rural non-migrant counterparts. One explanation for this is that migration has resulted in the creation of households in which the power structures and attitudes towards health are more conducive to the utilisation of prenatal care services. This increase in the utilisation of prenatal care with migration may have consequences for increasing the survival prospects of neonates. However, the increased utilisation of prenatal care services after migration to Mumbai is not only due to changes in household power structures. The increased availability of services and the increased socio-economic position of migrants relative to their rural origin also influence the utilisation of health services.

The utilisation of prenatal care and place of delivery

The logistic and multi-level logistic modelling of child mortality found the receipt of prenatal care was significantly related to the risk of mortality in the neonatal period. In addition, those who did not receive tetanus toxoid injections during pregnancy were significantly more likely to experience mortality in each of the three age groups analysed. The utilisation of maternal health services can have consequences for the health status of both the mother and the child. Prenatal care aims to promote the normal growth of the foetus and the health status of the mother, reducing the risk of both pregnancy related complications and producing a low birth weight baby (Rodriguez et al 1985; Anandalakshmy et al 1993; Goldenberg et al 1992). The delivery of a child in a formal health institution has been shown to be beneficial to the health of both the mother and child. Gunasekaram (1988) reported that the infant mortality rate for births occurring at home in India is 110 per thousand live births, considerably higher than the rate of 68 per thousand live births for those born in formal institutions. This higher rate of mortality among home deliveries is attributed to the problems faced in dealing with birth complications in a non-medical setting, and the lack of medical training held by traditional birth attendants (Prasad 1997). Therefore, the differences in both the utilisation of prenatal care and the places used for child delivery between migrants and non-migrants may act to create mortality differentials.

Women from both migrant and non-migrant groups who reported using prenatal care displayed a knowledge of the potential health care benefits of the service, which were suggested to be an important factor in their decision to seek care. These women appeared concerned about their health status during pregnancy, and believed that receiving care was particularly important for the health of the child. In contrast those who did not receive antenatal care were unaware of the health benefits of the service, and regarded maternal health care as a curative rather than a preventative measure. Previous studies have also shown that knowledge of the potential health benefits of prenatal care are an important motivating factor in the decision to seek care during pregnancy (Jejeebhoy and Rao 1995). The source of this health care awareness appears to be the health care workers in both urban and rural areas. Therefore, increased levels of prenatal care utilisation may be achieved through the adoption of a more provider driven service, with health awareness information taken directly to pregnant women.

The perception of prenatal care as a curative rather than a preventative measure proved to be a major barrier to the uptake of antenatal care services in both urban and rural areas, and among migrants and non-migrants. Women reported that they would only seek care if an obvious problem occurred during pregnancy, and that prenatal services had little benefit for their health. In addition to this, there prevailed a sense of apathy towards the seeking of care during pregnancy, particularly apparent among rural non-migrants interviewed in the Sikhwai village. Karnatikar and Sinha (1989) report that apathy towards the use of modern medical services coupled with an ignorance of the needs and advantages of maternal health care results in low rates of service utilisation in North India. Thus, it would appear that there exists an unmet need for health education aimed at those women who are not aware of the full benefits that maternal health care can have for both mother and child. However, Allyne (1976) note that health behaviour may be inhibited even when knowledge and attitudes are changed because of the constraints of conforming with the community, familial attitudes, and religious beliefs. In addition, cultural attitudes towards health are often generations old, and the women themselves may feel secure in following tradition rather than experimenting with modern medical methods.

The location of prenatal care services consistently proved influential in their utilisation. In the Sikhwai village the absence of prenatal care services within the village, and the need to travel over half-an-hour by vehicle to the nearest government hospital to access such services, proved to be the main reason behind the non-use of prenatal care among those women interviewed. Therefore, health education in itself may not be adequate to improve the levels of prenatal care utilisation. Although such education would increase awareness of the health benefits of prenatal care, the absence of services from which prenatal care can be obtained will still act to prevent maternal health care utilisation. This highlights another important area of improvement in maternal health care provision in India: services need to be available within the local area, both to allow access by potential users, and to stimulate interest in health care utilisation among the local population.

The case studies found no distinct urban - rural differential in the choice of the place utilised for childbirth. In both urban and rural areas women reported giving birth in their own homes, and in government and private medical institutions. The reasons for such choices were also consistent across rural and urban areas. The decision to give birth in a formal institution was often motivated by the belief that a higher quality of service could be gained than if the baby was born at home. Formal institutions, in particular private hospitals, were associated with safety during delivery. A financial hierarchy emerged, with private hospitals identified as the most costly place for child birth. Those who still wished to deliver in a formal institution yet could not afford the fees of a private hospital reported using government services. Again the location of such services proved an important factor in their utilisation, rural non-migrant women from the Sikhwai village reported a reliance upon home deliveries due to the distances involved in travelling to the nearest government hospital.

The rural area studied was characterised by a reliance upon home births. However, this is not to suggest that home births are a rural phenomena, with twelve of the twenty urban women interviewed also reporting home births. However, the number of home births was much higher in the rural-urban migrant group than the urban non-migrant group. The principal reason for the decision to deliver a child at home emerged as the perception of the service offered by the *dais* as being superior to those available in a formal institution. Women reported that they felt safe and reassured delivering their child in their own home. Basu (1990) suggests that the continued reliance upon home births is due to a combination of cost and tradition. Costs are incurred if childbirth takes place in an institution, even the free government services have indirect costs through transport and the removal of the woman from household employment. Thus, the poorest sectors of the population are economically inclined to depend upon the relatively more affordable *dai* conducted home delivery. In addition, child birth in a formal institution removes the woman from her own territory into an unfamiliar environment. In parts of India where the cultural status of women limits their exposure to formal health services, women are reluctant to attend a hospital due to their unfamiliarity and fear of institutions. The use of a *dai* ensures that the birth is conducted by a person of the same social mileau, thus reducing any sense of alienation for the mother. In this environment, dai conducted births become the accepted norm, and thus such traditions are hard to dissolve, despite the presence of modern health facilities.

The rural-urban migrant group displayed patterns of prenatal care utilisation similar to those observed in the urban non-migrant group. This indicates that for those interviewed migration to Mumbai is associated with the transition from an environment of low service utilisation to an urban area in which migrants adopt the urban pattern of high levels of service utilisation. The modelling of mortality found that the use of prenatal care was significantly related to the risks of under-two mortality. Hence, rural-urban migration may lead to an improvement in the survival prospects of those in early infancy, through an increased utilisation of prenatal care services. However, these results refer only to a small number of migrants in Mumbai, and do not necessarily indicate that rural-urban migration in other areas of India also leads to an increase in the utilisation of maternal health care services.

Migrants reported that prenatal care services were not utilised in their rural communities as they were not perceived as beneficial to health. In addition, migrants stated that they would not maintain the traditional practices surrounding pregnancy that they had performed in the rural areas. This suggests that migration is associated with changes in the perceptions of health care, with migrants no longer maintaining traditional rural practices in their new urban environment. The change in the perceptions of health care may be due to the differences in the availability of services between the urban and rural areas studied. Kanitkar and Archarya (1994) note that the availability of health services differs greatly between urban and rural areas of India. The health services in the rural area studied were operated through a charity organisation and were only open one day per week. In contrast, the urban area studied had charity operated health services, health workers, and a hospital within half an hour of the area. Hence, the exposure to a new service environment upon migration may act to increase both the migrant's knowledge and acceptance of health services, which in turn may increase the levels of service utilisation among rural-urban migrants in Mumbai.

The differences in the utilisation of prenatal care between rural-urban migrants and rural non-migrants were not apparent in the choices made for the place of delivery. High levels of home deliveries were found among both the rural-urban migrant and rural non-migrant groups, and the reason given for the decision to deliver at home were also similar between the two groups. This suggests that, although migration to Mumbai may involve an increase in the utilisation of prenatal care, there appears to be no change in childbirth practices. However, home births were also observed among the urban non-migrant group, and the motivations for home deliveries were similar to those in both the rural-urban and rural non-migrant group. Therefore, home births are not necessarily a rural phenomena, and migrants may thus be using the same childbirth practices as non-migrants in their new urban area. The prevalence of home births, and their association with increased risks of neonatal and maternal mortality, indicates the need to provide formal training to traditional *dai* and increasing the accessibility of medical institutions to the poorer sectors of Indian society.

The qualitative data presented in this chapter has provided a wider view of the process of rural-urban migration than is available in the Indian National Family Health Survey (1992). The interviews show that rural-urban migration is motivated primarily by the perceived economic opportunities in urban areas, and is also a response to economic push factors in the rural origins. Migrants reported that social networks, in the form of family members already living in the city, were an important source of assistance in assimilating into their new urban environment and as a source of information on the facilities available in the city. There is evidence to suggest that those without access to social networks experience problems in adapting to the urban area. These problems may have implications for child survival, particularly in areas in which the physical environment is characterised by informal housing and sanitation facilities, such that the environmental hazards are exacerbated by unfamiliarity with the urban area. The interviews also show that there are differences in the utilisation of prenatal care between rural-urban migrants and non-migrants, reflecting the patterns observed in the INFHS (1992) data. However, the interviews have also allowed the identification of the factors that may be influencing the change in the utilisation of prenatal care which occurs with migration to an urban area. The increased availability of prenatal care services in the urban areas relative to rural communities emerged as a strong influence on the decision for migrants to uptake prenatal care. In addition, migration is associated with a change in health care beliefs, which it is suggested act to increase the migrants acceptance of services and their ability to access prenatal care. The number of case studies conducted was too small to examine the relationship between migration and mortality, although the case study methodology adopted has allowed the identification of the factors influencing service utilisation. The results presented here suggest that mortality differentials may occur between migrant groups due to the differential utilisation of prenatal services. In addition, mortality differentials may be apparent within the rural-urban migrant population due to differences in migrants experiences of assimilating into their host urban society.

Chapter 8 summarises the main findings of this research, and provides conclusions and policy implications arising from both the quantitative and qualitative research.

Chapter 8 - Summary and Conclusions

8.1 Introduction

Brockerhoff (1990;1994;1995) reported that a three-level relationship exists between rural-urban migration and child survival in West Africa. It is suggested that the mortality rates of rural-urban migrants will be between that of their rural origins and urban destination, with the highest rates of mortality observed in rural areas. Thus, migrants are moving from the high mortality regimes of rural areas to the lower mortality regimes of urban areas, yet do not achieve the same low levels of mortality as those in their new urban environment. Brockerhoff (1994) suggests that this process can be explained by one, or a combination of two theories. Firstly, rural-urban migration is selective of those with socio-economic characteristics which predispose them to low levels of infant and child mortality. Hence the survival advantages of rural-urban migrants relative to rural non-migrants may be established prior to migration. Secondly, difficulties experienced by migrants in assimilating into their new urban environment may act to create mortality differentials between urban non-migrants and rural-urban migrants. Studies of urban anthropology suggest that migrant populations are inherently cohesive, forming distinct enclaves in urban areas, characterised by informal housing and poor sanitation facilities (Goldscheider 1989). These environmental conditions, together with the poor availability of health services in slum areas, create a migrant under-class associated with higher rates of infant and child mortality than are observed in the general urban population (Prasad and Somayjula 1992).

The principal aim of this thesis has been to examine the relationship between rural-urban migration and child survival in India, and to examine whether the relationship described by Brockerhoff (1990) is applicable to the Indian context. This research also aimed to examine the factors associated with under-two mortality and to estimate the degree of unobserved heterogeneity in child mortality, and to assess the inter-relationships that exist between these factors. These aims have been achieved by examining the survival outcomes for children in three periods: neonatal, early post-neonatal, and late post-neonatal and toddler, using logistic and multi-level logistic modelling techniques applied to the Indian National Family Health survey (1992) data.

The utilisation of maternal health care was identified as an important determinant of mortality in each of the three periods analysed. In addition, logistic modelling also showed evidence of differential utilisation of maternal health care services between migrants and non-migrants. Some of the motivational factors behind this differential utilisation of services were explained using a qualitative methodology. Case studies were conducted in and around Mumbai, India, with rural-urban migrants, and urban and rural non-migrants. The qualitative research focussed on the factors influencing the decision to use maternal health care, and examined differences in the motivational factors between migrant and non-migrant groups. In addition, the case studies collected information on the migration experiences of those who had recently migrated to Mumbai, in order to provide more information on the process of rural-urban migration than is available in the INFHS (1992). The results of the qualitative and quantitative analyses were combined to allow the relationship between rural-urban migration and child survival to be measured, and the factors that are acting to influence the relationship to be identified.

This chapter provides a summary of the main findings of this research, focussing primarily on the relationship between rural-urban migration and child survival. In addition, other factors which proved to be significantly related to under-two mortality are highlighted, and the spatial variations in mortality highlighted in the multi-level logistic modelling are summarised. However, the reader should refer to the relevant chapters for a comprehensive discussion of all the variables identified in each of the analyses.

8.2 Rural-urban Migration and Child Survival

The Indian National Family Health Survey (1992) has enabled the relationship between rural-urban migration and child survival to be examined in the Indian context for the first time. Brockerhoff's (1990) work on West Africa required amalgamating data from several Demographic and Health Surveys, in order to include enough migrants for analysis. This research has used the INFHS data for all 25 states of India, using a sample size of approximately 61,000, which includes 4,929 rural-urban migrants, hence allowing the relationship between rural-urban migration and child survival to be quantified within a single nation. In addition, the separation of the data set into north and south regions has allowed the identification of differing relationships between rural-urban migration and child survival. This indicates that the relationship between rural-urban migration and child survival in India cannot be explained by a single pattern, and that there are regional variations of the relationship that are influenced by the socio-economic and cultural characteristics prevalent in the north and south of India.

The models for neonatal mortality show that when migration status is included as the only independent variable there is a significant difference in the odds of mortality between rural-urban migrants and rural non-migrants. There is no significant difference in the odds of mortality between rural-urban migrants and urban non-migrants. The significant difference between rural-urban migrants and rural non-migrants was no longer evident with the inclusion of the socio-economic and health care utilisation variables. Rural-urban migration is selective of those in the younger age groups and with higher educational attainment. Thus, the selectivity of the rural-urban migrant population in terms of their socio-economic characteristics associated with low levels of infant mortality, and the differing utilisation of maternal health care services between urban and rural areas are suggested as the main causes of mortality differentials between rural-urban migrants and rural non-migrants.

A significant relationship was observed between migration status and early post-neonatal mortality only when birth intervals were included in the model. Again, the differences in mortality were observed between the rural-urban migrant and rural non-migrant groups. No significant difference in mortality was apparent between rural-urban migrants and urban non-migrants. Rural-urban migrants are moving to urban areas with a greater availability of maternal health care, and the educational selectivity of the group indicates a greater propensity to utilise such services. In contrast, rural non-migrants reside in environments characterised by low service availability, and the case-studies conducted in rural areas suggested that maternal health service use was perceived as a curative rather than preventative measure. Indeed, the modelling of the health care determinants of mortality found that, relative to rural-urban migrants, rural non-migrants had a 68%

lower odds of receiving prenatal care. Thus, it is suggested that although rural-urban migrants have greater risks of early post-neonatal mortality due to their high percentage of first births, the increased use of maternal health care services relative to rural non-migrants acts to compensate for this, and in turn creates mortality differentials between rural-urban migrants and rural non-migrants.

The modelling of late post-neonatal and toddler mortality found that when migration status was included as the only independent variable significant differences were apparent in the odds of mortality between migrant groups. Relative to rural-urban migrants, rural non-migrants displayed higher odds of mortality, whilst urban non-migrants displayed lower odds of mortality. Hence, there is evidence to suggest that Brockerhoff's (1990) three level relationship is present in the late post-neonatal and toddler period. However, the significant relationship between migration status and mortality is no longer apparent with the introduction of the socio-economic and health care utilisation variables, suggesting that differences in the distribution of these factors between migrant groups explains the presence of mortality differentials.

The modelling of the inter-relationships between the determinants of mortality showed that rural-urban migrants had patterns of maternal health care utilisation between that of the rural and urban non-migrants. In addition, the socio-economic and environmental characteristics of rural-urban migrants were between those of the rural and urban non-migrants. Therefore, the three-level relationship between rural-urban migration and late post-neonatal and toddler mortality is reflected in the similar three-level relationships between migration status and the health care and socio-economic determinants of mortality. Thus, rural-urban migrants have lower odds of experiencing late post-neonatal and toddler mortality than rural non-migrants due to a combination of their selectivity on characteristics associated with low rates of child mortality, and their move to an environment of greater health service availability. However, problems experienced in assimilating into the new urban environment create mortality differentials between rural-urban migrants and urban non-migrants.

At the all-India level, two different relationships have been observed between rural-urban migration and mortality. In the neonatal and early post-neonatal periods, differences in the odds of mortality exist between rural-urban migrants and rural non-migrants. It is suggested that this is a product of a combination of the selectivity of rural-urban migrants in terms of socio-economic characteristics, and the migration to an environment of greater health service availability. However, in the late post-neonatal and toddler period, mortality differentials emerge between rural-urban migrants and urban non-migrants. The socio-economic and environmental determinants of mortality increase in importance with the age of the child, and thus in this age group the differences in the standards of living between urban non-migrants and rural-urban migrants act to create mortality differentials not apparent in earlier age groups.

The separation of the states into north and south allowed the identification of differing relationships between rural-urban migration and mortality. In north India, other migrants had significantly higher odds of experiencing neonatal mortality relative to rural-urban migrants. The other migrant group is comprised predominantly of rural-rural migrants, who are from the poorest sectors of rural society. In contrast, rural-urban migration is selective of those from the younger ages and higher educational groups. In addition, rural-rural migrants are migrating between similar environments of service availability. Rural-urban migrants are moving from the low service availabilities of rural areas to urban areas with a greater range of health services available. Therefore, the relationship observed between migration status and neonatal mortality in north India is due to a combination of the differing socio-economic characteristics of the two migration groups, and the differential utilisation of maternal health care services. The differences in the use of maternal health care are a product of both the differing service availabilities in rural and urban areas, and the prevailing belief in rural areas that prenatal care is a curative rather than preventative measure.

In south India urban non-migrants displayed lower odds of late post-neonatal and toddler mortality than rural-urban migrants. There was no difference in the risk of mortality between rural-urban migrants and those who remained in rural areas or the "other migrants" category, despite differences in the socio-economic characteristics between the migrant groups. Hence, it would appear that in south India, migrants who move from a rural to an urban area do not experience a difference in their risk of late post-neonatal and toddler mortality relative to their rural origin. Thus, there are two mortality regimes, the urban and the rural, and migrating from the high to the low regime does not lead to a difference in survival rates among migrant children. This is in contrast to the work of Brockerhoff (1994: 1995) which suggests that the survival rates of rural-urban migrants will be between those of the rural origin and urban destination.

Brockerhoff's (1990) three-level relationship between migration and mortality does not, therefore, seem adequate in explaining the Indian context. Brockerhoff (1990) suggested that this relationship could describe the patterns evident in West Africa. However, this research has shown that the relationship between rural-urban migration and child survival is too complex to be described by a single relationship. Brockerhoff (1990) excluded neonates from his analysis, suggesting that the determinants of neonatal mortality were largely biological and would not be influenced by migration. This research has shown that neonatal mortality is significantly related to rural-urban migration, and that the relationship is due predominantly to changes in maternal health service utilisation with migration to an urban area. This research has also examined other areas of the migration-mortality relationship which Brockerhoff (1990) suggested would be influential in child survival. The timing of migration, in relation to marriage and the birth of the child were not significantly related to mortality, and the duration of residence in the urban area showed no association with child survival. These results suggest that the timing of migration is not important in determining child survival, and that the mortality advantages or disadvantages of rural-urban migrants do not diminish with duration of residence in their new urban environment.

This research has shown that rural-urban migration influences child survival through a number of direct routes. Migration status was not significantly related to mortality at the all-India level, yet the modelling of the inter-relationships between the determinants of mortality found that migration status was significantly related to factors associated with mortality. Migration status was consistently associated with variables indicating maternal health care utilisation and socio-economic status, and these variables proved to control for the relationships between migration and mortality. The rural-urban migrant population had levels of maternal health care utilisation and standards of living between that of the rural and urban non-migrant populations. Thus, this research concludes that the cause of differential mortality between rural-urban migrants and non-migrants is a combination of differences in socio-economic status and the utilisation of maternal health care. The selectivity of rural-urban migrants and the exposure to a new service environment creates mortality differentials between rural-urban migrants and rural non-migrants. However, differences in the standards of living and problems in assimilating into the urban environment create mortality differentials between rural-urban migrants and urban non-migrants, although these are not evident until the late post-neonatal and toddler period.

8.3 The Process of Rural-Urban Migration

The INFHS data are limited in terms of the migration data available. The case-studies conducted in Mumbai provided more information on the process of rural-urban migration, identifying the motivations, costs, and advantages behind the decision to migrate to Mumbai. The interviews suggest that migration between rural and urban areas is a response to low wages and high unemployment in rural areas, and the perception of economic opportunities in Mumbai. Respondents reported that rural-urban migration involves considerable financial costs, which were met by either borrowing money from family members, or selling personal possessions and land in rural areas. Thus, migration to Mumbai is an investment making decision, with the perception of employment in the city providing the primary pull factor. Social networks, in the form of family members or previous migrants, were identified as the main sources of assistance in assimilating into the new urban environment. Family members living in the city provided employment and temporary accommodation, and information on the location of services. However, those without access to social networks reported experiencing difficulties adapting to their new urban life-style. This suggests that assimilation into the urban environment for those rural-urban migrants with access to social networks is easier than for those migrants who arrive in Mumbai with no social support systems. Social networks were also identified as a source of information on maternal health care services. Thus, the differential utilisation of services between urban non-migrants and rural-urban migrants, identified in the logistic modelling of the determinants of service use, may be due to differential access to social networks among rural-urban migrants. Hence, given that the use of maternal health services is significantly related to the risk of under-two mortality, it seems plausible to suggest that the degree to which rural-urban migration influences under-two mortality may be mediated by the migrants's exposure to social networks in their new urban environment.

8.4 The Utilisation of Maternal Health Care

The logistic and multi-level logistic modelling found that the utilisation of prenatal care was significantly related to mortality in all three age groups. However, the data on the use of maternal health care in the INFHS describes only whether services were used, and not the types of services or the motivations behind the decision to seek care in pregnancy. The case-studies conducted in Mumbai found similar patterns of service utilisation and health care beliefs among rural-urban migrants and urban non-migrants. In contrast, the rural population studied was characterised by low levels of prenatal care use, and the belief that prenatal care was a curative rather than preventative measure. In addition, the lack of health services in the rural area resulted in women not being able to seek care during pregnancy, even if they felt that such care was necessary. The results of the case-studies, combined with the results of the modelling of health care utilisation, suggest that migrants are moving between two different environments of service availability, which in turn leads to increased uptake of services among rural-urban migrants. The similarity in the health care beliefs between rural-urban migrants and urban non-migrants suggests that migration is selective of those with characteristics which predispose them to service utilisation. Given that the utilisation of maternal health care proved to be significantly related to under-two mortality, this research suggests that the relationship between migration status and child mortality is influenced by both the exposure to a greater availability of health services in the new urban area, and the selectivity of migration in terms of those with characteristics which are associated with service utilisation.

8.5 Multi-Causal Nature of Child Mortality

The modelling of under-two mortality found that the determinants of mortality change with the age of the child. Neonatal mortality was largely determined by bio-demographic factors, whilst the late post-neonatal and toddler period marked the influence of socio-economic and environmental factors on mortality. These results are consistent with previous studies which have suggested that the determinants of mortality change with the age of the child (Bhatia 1989). The logistic and multi-level logistic modelling of under-two mortality found that no single factor could explain the risks of mortality in any of the three age groups analysed. In addition, the modelling of the inter-relationships between the factors associated with mortality showed that the determinants of mortality were often strongly correlated, suggesting the multi-causal nature of under-two mortality in India. It was discovered that bio-demographic determinants were largely influenced by health care utilisation and socio-economic characteristics, indicating that the impact of the biological determinants of mortality are influenced by the health care behaviour and socio-economic background of the individual. Health care utilisation is largely determined by individual socio-economic characteristics, with those achieving levels of education beyond primary and having indicators of a higher standard of living displaying the greatest odds of receiving each of the services modelled. There also exist inter-relationships between the indicators of health service utilisation. This result suggests that there exists a particular health seeking behaviour, in which an individual who is likely to utilise one particular health service is similarly predisposed to utilise all maternal health care services.

8.6 Sex Differentials in Mortality

Evidence was found of sex differentials in mortality, with females experiencing greater survival prospects in the neonatal period. However, this survival advantage had reversed by the late post-neonatal and toddler period, whereby females were more likely to experience mortality than males. Sex differentials in mortality among children have been attributed to the preferential treatment of the male child in terms of the allocation of resources and health care utilisation (Das Gupta 1990; Dyson and Moore 1983). This process is the product of the cultural traditions of the society, and hence sex differentials in mortality are non-uniform across societies (Badari 1983; Bajkhaif and Mahadeven 1993). In India it is suggested that sex differentials in mortality, particularly those prevalent in the northern states, are a product of differential uptake of health resources (Basu 1990). It would thus seem plausible to suggest that the sex differential in mortality found in the late post-neonatal and toddler period is a result of the differential allocation of resources between the sexes, which is in a turn a product of the cultural behaviour prevalent in a particular region.

8.7 Unobserved Heterogeneity in Under-Two Mortality

The multi-level modelling of mortality found significant mother level random effects in both the neonatal and late post-neonatal and toddler periods. Das Gupta (1990) reports that death clustering in families may reflect differences in biological factors, such as genetically determined frailty, or a tendency for certain mothers to have babies of low birth weights, or to suffer difficult deliveries, or lactational failure. Das Gupta (1990) also found significant clustering of deaths even after controlling for the biological determinants of mortality, maternal education and socio-economic characteristics of the household, suggesting that death clustering may be due to differences in child care practices which are largely unobservable. However, the Indian National Family Health Survey (1992) does not include some variables which Das Gupta (1990) found to be related to the risk of neonatal mortality, such as lactational failure and protracted deliveries. Hence, the significant random effect in the neonatal period may reflect the omission of such potential determinants of mortality, as well as unmeasurable influences on mortality.

Significant cluster level random effects were observed in both the neonatal and late post-neonatal and toddler age groups. The Indian National Family Health Survey (1992) collected village level data for rural areas, detailing the presence of health and educational service in each village. However, at the time of analysis this data was not yet available. Data on the presence of services in urban areas was not collected. Therefore, the significant cluster level random effects may reflect the omission of service availability data, as it seems plausible to suggest that the presence of health service within an area would have an influence on the levels of infant mortality. The significant cluster level random effect may also represent cultural variations in child care practices, which influence the management of childhood illness and the utilisation of health services.

8.8 Spatial Distributions in Under-Two Mortality

The logistic and multi-level modelling of mortality found wide state-level variations in the odds of under-two mortality. A clear north-south divide emerged, with the highest odds of mortality observed in the northern states. This finding is in accordance with previous studies which have suggested the existence of a north-south demographic dichotomy in India (Dyson and Moore 1983). However, this research has shown that the division of India into broad north and south regions is not adequate in explaining the state variations in mortality. There are also state-level variations in neonatal mortality within the north and south regions, although the regions appear homogenous in terms of the odds of early post-neonatal and late post-neonatal and toddler mortality. The models controlled for differences in socio-economic characteristics and health care utilisation between states, suggesting that the state-level variations in mortality are due to other unobserved differences between states. It is suggested that this state-level heterogeneity in mortality is the product of differing child care practices and attitudes towards the utilisation of health care, which have been shown to have wide regional variations in India (Basu 1990), and cannot be measured in a large scale social survey such as the INFHS.

8.9 Policy Implications

Migration status proved to be significantly related to the utilisation of maternal health care services, with the highest rates of service use observed among urban non-migrants. Although rural-urban migrants displayed higher levels of service utilisation than rural non-migrants, they did not achieve the same high levels of service use as those who had always lived in urban areas. In addition, differentials emerged in the standards of living between rural-urban migrants and urban non-migrants, such that migrants form a distinct under-class in their new urban environment. Therefore, policies aimed at providing maternal care services need to recognise that urban areas are not homogenous, but there exist intra-urban differentials between migrant groups. Thus, attention is needed in providing maternal health care services to migrant groups, whom it has been shown often lack the social networks to allow them to access the services provided in urban areas. Previous studies have shown that the presence of social institutions encouraging interaction between migrants and non-migrants can aid the assimilation of migrants into their new urban environment (Abu-loghod 1966). The provision of such institutions may also act as a source of information on the availability of health services to new migrants.

Mortality differentials were evident between rural-urban migrants and rural non-migrants, with the highest rates of mortality observed in rural areas. The case-studies conducted around Mumbai show that the main barriers towards health service utilisation in rural areas were travel costs and distances to the nearest service. In addition, rural areas were characterised by the belief that prenatal care was not beneficial for the health of the mother or child. Therefore, greater provision of maternal health care services is needed in rural areas, with services provided in close proximity to villages, operating at times that are conducive with the daily routine of village life. In addition to service provision, there exists the need to provide education on the potential benefits of prenatal care, and to encourage rural women to perceive prenatal care as a preventative health measure. In particular, the timing of prenatal care in pregnancy was shown to be significantly related to neonatal mortality. Hence, it is important that women are encouraged to seek prenatal care in the early stages of pregnancy, and are provided with information on the risks associated with pregnancy to allow them to identify danger signs in pregnancy, and thus seek care to prevent further problems.

State-level variations in under-two mortality were evident in both north and south India, indicating that policies aimed at reducing infant and child mortality must take into account the individual characteristics of each state. The distribution of the utilisation of maternal health care by state shows large disparities, particularly in the north of India, whilst the highest rates of mortality are consistently observed in the large northern states. Therefore, attention is needed not only in improving the provision of health care services within the northern states, and thus reducing the inequalities in heath care provision between north and south, but also in encouraging women in north India to utilise prenatal and child health services.

The multi-level logistic modelling of mortality found significant cluster level random effects in late post-neonatal mortality. This was attributed to a combination of regional variations in health service use and availability, and variations in child care practices.

Therefore, health care policy must also recognise that variations in availability, and consequently utilisation, exist at the regional level. Thus, state-level policy must examine intra-state differences in the provision of health care, and establish policies aimed at small local areas to encourage health care utilisation.

The level of rural-urban migration in India has been increasing over the past two decades, and hence the problems highlighted in this research may be expected to increase in volume as the number of rural-urban migrants continues to grow. In particular, as rural-urban migration increases there will be an associated increase in the numbers of those living in the lower socio-economic strata of urban areas, creating greater stresses on already scarce health care services. Thus, health policy needs to target the provision of health resources towards slums, in order to ensure that the growing numbers of people living in the poorest economic conditions have access to health care. In addition, the continued out-migration from rural areas of those in the younger age groups and with higher educational attainment may act to increase the rural-urban dichotomy in standards of living and infant and child mortality. Therefore, policy attention is needed to discourage rural-urban migration. The case-studies showed that the primary reason for migration to Mumbai was to seek employment. Hence, an investment in rural infrastructures and the creation of employment opportunities may remove the present need for rural-urban migration.

8.10 Future Research

The utilisation of maternal health care has been shown to be significantly related to under-two mortality. However, the INFHS only included data on whether prenatal care was sought, and the number of visits and timing of the visits in pregnancy. The qualitative research highlighted the range of services utilised for prenatal care within one urban population, thus it would be interesting to model under-two mortality in terms of the type of prenatal care received. The second round of the INFHS, currently under collection, will include data on the type of prenatal care received, the reasons behind the decision to utilise prenatal care, and the treatments received during the prenatal care visit. Hence, future research may model the effects that the different types of prenatal care have on infant and child mortality, and also examine the possibility of relationships between migration status and the receiving of different types of prenatal care.

The qualitative research highlighted the differing availability of prenatal care services between urban and rural areas, and also showed that rural areas were associated with the belief that prenatal care was not beneficial to the health of the mother or child. However, these results are provided by small scale in-depth studies conducted in one rural area of Maharashtra. Thus, there is clearly a need to examine the extent to which these health care beliefs are indicative of rural areas throughout India, which could in turn provide information to inform policy on the provision of health services in rural areas.

Significant cluster level random effects terms were found in the modelling of late post-neonatal and toddler mortality. In addition, state-level variations were present in under-two mortality, even after controlling for socio-economic characteristics and the utilisation of maternal health care. Therefore, research is needed to examine the causes of this unobserved heterogeneity in mortality. This research suggests that this unobserved heterogeneity is due to both lack of data on health service provision, and factors that cannot be easily measured in a large scale social survey. Hence, a combination of qualitative and quantitative research methodologies is required in order to examine the factors operating to create woman, cluster, and state level heterogeneity in mortality.

The migration data available in the Indian National Family Health Survey (1992) are limited, with only the duration of residence and the type of both the current and previous place of residence recorded. Therefore, there exists the need to improve the range of migration data collected in large scale social surveys. Migration histories could be collected using a similar method to that used in the collection of birth histories, allowing the identification of different types of migrants (return migrants, and those involved in step-migration). In turn, this would allow the influence of each type of migrant on child mortality to be modelled. In addition, the costs and distances involved in migration could be recorded, which would permit the modelling of the relationships between different aspects of the migration process and the survival prospects of children. This analysis has been restricted to using a broad definition of a migrant, and it seems plausible to suggest that increased data on migration would allow the identification of more complex relationships between migration and mortality that are not apparent in this research.

The qualitative research highlighted the motivations behind the decision to migrate from rural areas to Mumbai, and detailed the mechanisms through which migrants assimilate into their new urban environment. The results suggest that the migrant population is not homogenous, with a range of migration experiences reported. However, these results refer only to a small number of migrants interviewed in Maharashtra. Thus, further research is needed to examine the extent to which migrant behaviour, in particular the motivations behind migration, is homogenous throughout India, and to examine state-level variations in migrant behaviour. This research has treated rural-urban migrants as an homogenous group. However, the identification of differing types of migrants, with differing motivations and experiences of urban assimilation would allow variations in child mortality within migrant groups to be examined.

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Appendix 4.1
Variables used in the creation of the Standard of Living Index

Variable	Frequency (%)	Score
Source non-drinking water		
Piped water	18.0	5
Public tap	13.8	3
Handpump	29.0	2
Well	24.4	1
Other	12.9	0
Type fuel used for cooking		
Wood	67.2	2
Cow dung cakes	10.0	1
Liquid Petroleum Gas	9.9	3
Other	11.3	2
Main source of lighting		
Electricity	54.0	3
Kerosene	45.3	2
Other	0.7	1
Separate room used for cooking		
Yes	55.5	2
No	44.3	1
Own Livestock		
Yes	58.0	2
No	41.9	3 (rural) 1 (urban)
Own agricultural land		
Yes	53.6	2
No	46.4	1
Own a sewing machine		
Yes	23.8	2
No	76.2	1
Own a clock / watch		
Yes	56.0	2
No	43.9	1
Own a sofa set		
Yes	10.3	4
No	89.6	1
Own a fan		
Yes	34.3	3
No	65.7	2
Own a radio / transmitter		
Yes	40.4	2
No	59.6	1

Variable	Frequency (%)	Score
Own a refrigerator		
Yes	7.2	5
No	92.8	2
Own a television		
Yes	22.4	3
No	77.6	2
Own a VCR		
Yes	2.7	5
No	97.3	2
Own a bicycle		
Yes	40.0	3
No	60.0	2
Own a motorcycle / scooter		
Yes	8.6	5
No	91.3	2
Own a car		
Yes	1.3	5
No	98.6	2
Own a tractor		
Yes	1.6	5
No	76.7	2
Own a thresher		
Yes	1.5	5
No	76.8	2
Own a bullock cart		
Yes	5.4	4
No	73.0	2
Own a water pump		
Yes	5.4	4
No	72.9	2
Total	100.00	
Max	74	74
Min	31	31

The above table shows the variables used in the creation of the Standard of Living Index. Each category of each variable was given a score to indicate the socio-economic status that this characteristic represented. In each variable the most frequent category was scored as 2, and the other categories were given scores ranging from 0 to 5, where 5 represents a high socio-economic status, and 0 a low socio-economic status. The scores were awarded using the distribution of the other categories relative to the category scored as 2.

Appendix 4.2

Variables Used in Bivariate Analysis of Mortality

Migration

1. Migration status
2. Age at migration
3. Duration of residence
4. Child born before / after migration
5. Migrated before / after marriage

Bio-demographic

6. Previous birth interval
7. Multiple birth
8. Consanguineous marriage
9. Mothers age at birth of child
10. Parity
11. Survival status of previous child
12. Sex of child
13. Prematurity
14. Size of child at birth
15. Ever breastfed*
16. Time of weaning*

Environmental

17. Type of house
18. Household density
19. Source non-drinking water
20. Toilet facility

Socio-economic

21. Current marital status
22. Age at marriage
23. Caste
24. Maternal education
25. Husbands occupation
26. Index of exposure to media
27. Husbands education
28. Religion
29. Standard of Living Index
30. Mothers occupation

Health care utilisation

31. Received antenatal care
32. Received iron / folic acid tablets during pregnancy
33. Received tetanus toxoid injections during pregnancy
34. Place of delivery
35. Months pregnant when sought antenatal care
36. Number of antenatal care visits

Geographic

38. Live in backward district
39. State
40. Locality

All variables were significantly related to mortality (at the 5% level) in the neonatal, early post-neonatal and late post-neonatal and toddler periods.

* "Ever breastfed" was used in the early post-neonatal period, "time of weaning" was used in the late post-neonatal and toddler period, and no breast feeding variables were used in the neonatal period.

Appendix 4.3
Interactions Fitted in Logistic Modelling of Mortality

	Neonatal	Early Post-neonatal	Late Post-neonatal / Toddler
State* mothers education	✗	✗	✗
State* household density	✗	✗	
State* place of delivery	✗		
State* months pregnant when sought antenatal care	✗		
State* received tetanus injection during pregnancy	✗	✗	✗
State* sex of child	✗		✗
State* index of exposure to media		✗	
State* consanguineous marriage		✗	
State* Standard of Living Index			✗
Migration * mothers education	✗	✗	✗
Migration * household density	✗	✗	
Migration * place of delivery	✗		
Migration * months pregnant when sought antenatal care	✗		
Migration * received tetanus injection during pregnancy	✗	✗	✗
Migration * State	✗	✗	✗
Migration * index of exposure to media		✗	
Migration * Standard of living Index			✗
Birth interval * mothers age at birth	✗	✗	
Birth interval * survival status of previous child	✔	✗	✗

✗ Interaction fitted but not significant at 5% level
✔ Interaction significant at 5% level

Appendix 4.4
Variables Fitted in Logistic Modelling of Under-two Mortality

	Neonatal	Early Post-Neonatal	Late Post-Neonatal & Toddler
Migration variables			
Migration status	✔	✔	✔
Age at migration	✔	✔	✔
Duration of residence	✔	✔	✔
Migrated before / after marriage	✔	✔	✔
Child born before / after migration	✔	✔	✔
Socio-economic variables			
Live in backward district	✔	✔	✔
Locality (size of town)	✔	✔	✔
Type of house	✔	✔	✔
Household density	✔	✔	✔
Husbands occupation	✔	✔	✔
Woman's occupation	✔	✔	✔
Maternal education	✔	✔	✔
Husbands education	✔	✔	✔
Can husband read / write	✔	✔	✔
Current marital status	✔	✔	✔
Age at marriage	✔	✔	✔
Religion	✔	✔	✔
Caste	✔	✔	✔
Standard of Living Index	✔	✔	✔
Toilet Facility	✔	✔	✔
Source non-drinking water	✔	✔	✔
Index of exposure to media	✔	✔	✔

	Neonatal	Early Post-Neonatal	Late Post-Neonatal & Toddler
Bio-demographic variables			
Previous birth interval	✔	✔	✔
Single / multiple birth	✔	✔	✔
Consanguineous marriage	✔	✔	✔
Mothers age at birth of the child	✔	✔	✔
Parity	✔	✔	✔
Survival status of previous child	✔	✔	✔
Sex of child	✔	✔	✔
Size of child at birth	✔	✔	✔
Premature birth	✔	✔	✔
Ever breastfed	✘	✔	✘
Months breastfed	✘	✘	✔
Health care utilisation			
Received antenatal care	✔	✔	✔
Number months pregnant when received antenatal care	✔	✔	✔
Number of antenatal care visits	✔	✔	✔
Received tetanus toxoid injections during pregnancy	✔	✔	✔
Received iron folic acid tablets during pregnancy	✔	✔	✔
Place of delivery	✔	✔	✔
Geographic			
State	✔	✔	✔

✔ Variable was entered into the model, not necessarily an indicator of the significance of the variable.
✘ Variable was not entered into the model.

Appendix 7.1: Interview Schedule: Case Study

Comparison of the utilisation of maternal and child health care services between migrants and non-migrant populations in Mumbai, India.

Researcher: Mr Rob Stephenson. Southampton University, England.

Guide: Professor Rama Rao. IIPS, Mumbai.

The information included in this schedule is to be used for confidential research purposes only.

Section One: Demographic Characteristics:

1. Name of town / district/ ward / village:

2. Religion:

3. Caste:

4. Household Structure. Please fill in table overleaf for each person usually present in the household.

1 = Relationship to head of Household
2 = Marital status
3 = Occupation (for those aged 6+)
4 = Have you attended school ? (for those aged 6+)
5 = If YES, are you now attending and what class ?
If NO, what class did you leave school at ?

P.T.O

Name	Sex	DOB	Age	1	2	3	4	5
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								
11.								
12.								
13.								
14.								
15.								
16.								
17.								
18.								
19.								
20.								

Section Two : Migration History

6. Length of time lived in current residence by woman (in years):

7. Name of previous place of residence:
Town / ward / village.

8. Was this an urban / rural area ?

9. How far away in kilometres is the families previous place of residence ?

10. Place of birth of woman:

11. Distance in kilometres to woman's place of birth:

12. How many moves have you made in the past 10 years ?
For the woman please fill in the table over leaf detailing migrations made in the last ten years:

13. Did your husband move here first ?
If YES, how much longer was it before you moved to join your husband ?

14. Did all members of this household move here together ? If not, please detail which members moved together, when they moved, and time intervals between household members moving.

15. Are there any members of your immediate family remaining in your previous place of residence ? If YES, please list and their ages.

16. Did all members of this household live together in your previous place of residence ? If NO, probe to find out who lived with whom.

17. What was the main reason for your husband moving to this area? Probe to find out how many reasons there were, and list them all. If there was more than one, ask which was the most important reason.

18. Before moving to this area did you or your husband have any friends or relatives living here ? Please list.

19. Did they influence you or your husbands decision to move ? If YES, how did they influence you ?

20. Could they offer you or your husband any help when you arrived here ? Probe to find out what kind of help was offered.

21. What knowledge did your husband have of this area before you came here? Where did this knowledge come from ? Probe to find out friends / relatives / other sources.

22. Was your husband aware of any advantages of moving to this urban area before he moved here ? If YES, probe to find out what the advantages were.

23. Was your husband aware of any disadvantages of moving to this urban area before he moved here ? If YES, probe to find out what the disadvantages were.

24. Whose decision was it for your husband to make the move ?
Probe to find out whether husband or other household member made the decision. If another household member, was woman in agreement ?

25. What was the main reason for you to move to this area ? Probe to find out how many reasons there were, and list the them all. If there was more than one, which was the most important reason ?

26. What knowledge did you have of this area before you came here? Where did this knowledge come from ? Probe to find out if it was from friends / relatives or husband

27. Were you aware of any advantages of moving to this urban area before you moved here ? If YES, probe to find out what these advantages were.

28. Were you aware of any disadvantages of moving to this urban area before you moved here ? If YES, what were these disadvantages ?

29. Whose decision was it for you to make the move here ? Probe to find out whether woman or other household member made the decision ? if another household member made the decision, was the woman in agreement ?

30. Does your family own any agricultural land in your previous place of residence ? If so, what has happened to this land? Probe to find out of they return to tend the land.

31. Have you made return journeys to your previous place of residence ? If YES, how often do you return ?

32. Who make the return journeys, you, your husband, or other family members ?

33. Why does this person or yourself return to your previous place of residence ?

34. How long do yourself or other family members stay when you return to your previous place of residence ?

35. What did it cost you to move here ?

36. How did you pay for the move here ? Probe to find out if used savings or borrowed money.

37. What was your average monthly household income in your previous place of residence ?

38. What is your average monthly household income now ?

39. What was your husbands occupation in your previous place of residence ?

40. What was your occupation in your previous place of residence?

41. Were costs of migrating important in deciding your move ?

42. Have you gained economically from moving to this area ?
If YES, how have you gained ?
If No, what economic problems have you faced ?

43. Have you gained socially from moving here ?
If YES, how have you gained ?
If No, What problems have you faced ?

44. Have you faced any problems in adapting to living in this area ? If so, what are the problems you have faced ?

45. Do you miss your previous place of residence ? If Yes, why ? If No, why not ?

46. In general, do you feel that moving here was beneficial to your family, in particular your children ? If YES, why ? If NO, why not ?

P.T.O

Move	Year moved	Years lived there	Dist	Who moved first	Reason	Job
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						

Section Three: Socio-economic status of the household:

47. OBSERVATION: Interviewer to answer the following questions by observing the household environment.

* Is there any sign of damp or moisture in the house ? If so, where ?

* Is there any sign of waste littering the house ? Please describe.

* Is there any sign of fly nuisance ?

* Is the household situated near waster disposal site ? Please describe.

48. Number of persons currently living in the house:

49. Occupancy status: Owner or Tenant ?

50. Number of rooms in household:

Kitchen	( )
Dining room	( )
Reading room	( )
Bathroom	( )
Bedrooms	( )
Others	( )

51. Separate room used for cooking: Yes or No:

52. Source of fuel used for cooking:

53. Do you have a chimney where you cook fuel to help expel the fumes ?

54. Are the cooking vessels cleaned with mud, powder, soap, or something other than these ?

55. Does the household have electricity:

56. Type of materials used to build the house:

Roof:
Walls:
Floor:

57. How many windows in the house:

58. How many adjoining walls:

59. From which place do you get your drinking water ?

60. From which place do you get your washing and bathing water?

61. Do you clean or purify your drinking water before using it?
If YES, how ? If No, why not ?

62. How much time does it take you to fetch drinking water ?

63. How much time does it take you to fetch bathing and washing water ?

64. How do you dispose of water ?

65. What type of toilet facility do you use ?

66. How long does it take you to get to the toilet facility?

67. How do you dispose of your toilet waste ?
Probe to find out whether there is a designated area for this kind of waste and how close to the home the waste is disposed of.

68. Where do you dispose of your garbage ?
Probe to find out if there is a special area where everyone throws rubbish or do different people in the nearby houses uses different places ? Is it disposed of near to the house?

69. Do you own any animals and livestock ?
If yes, what are they ? Where so they live ?

70. Does the household own a television ?
If NO, do you watch television programmes in a neighbours house ?

71. Does the household own a radio ?

72. Does the household have access to any type of vehicle ?
If YES, what type and who owns it ?

73. Did all eligible members of the household vote in the recent election? If Yes, Who.
If respondent didn't, why not ?

74. Where do the family members sleep at night ?

Probe to find out whether all members sleep in the same place or whether some have cots to sleep in and some sleep on the floor. If different members sleep in different places then record which members sleep in which place). Observe to note the sleeping conditions of the family.

P.T.O

Section Four: Pregnancy and Child Birth:

75. How many pregnancies have you had in the past ten years ?

76. For each of the pregnancies fill in the table below:

Age of Mother	DOB of child	Age of child	Survival status	Age at death	Cause of death	Place of Delivery
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

77. For each of the pregnancies fill in the table overleaf listing the antenatal care received, the number of months pregnant when antenatal care was sought, and the type of care:

P.T.O

Child	ANC Y/N	Months Preg when ANC	Number of visits	Source	Received tetanus injection **	Received iron folic acid
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

ANC = Ante-natl care
** Ask how many Tetanus injections were received

78. Whilst you were pregnant with your last child did you visit:
   a) an antenatal clinic Yes / No
   b) visit a health worker Yes / No
   c) Did a health worker visit you Yes / No

79. If YES, why did you use antenatal care ?
If NO, why did you not seek antenatal care ?
Probe for whether she knew about the services but chose not to use it for some reason or whether she simply was unaware that the services were available

80. How many months pregnant were you when you first sought antenatal care, and how many visits were made before the end of the pregnancy ?

81. Where was your last child delivered ?

82. Why did you choose to deliver your child here ?
Probe to find out whether it was her decision or a family decision, whether she was following tradition or whether she thought it was in the best interests of here own health.

83. If your last child was delivered at home, did you receive any special treatment or medicine ? If YES, please describe.

84. Who conducted the birth of your last child ?

85. Why did you choose to have that person deliver your child ?
Probe to find out whether it was the respondents decision, tradition, or the only person available.

86. **MIGRANTS (ask to migrants only):**

a) What types of services for maternal health care were available in your previous place of residence ?

b) What ante-natal care services did you or people in your community use in your previous place of residence ? List all services used, the types, and the frequency used.

c) What are the reasons for people in your previous community for not using ante-natal care ?

d) What maternal health services are available here that were not available in your previous community ? Please list all services.

e) What were the places of delivery used for child birth in your previous community ? Why were these places used ?

f) Did the availability of health services here influence your decision to move ?If yes, how ?

g) Since you have moved has there been any change in the frequency of health services used ? If YES, Why ?

h) Who makes the decision to use the type of services you use ? Why does this person make the decision ?

I) Who made the decision to use services in your previous place of residence ? If it has changed, why ?

j) Were you aware of any traditional practices that were carried out during child birth in your previous place of residence ? Probe to find out exactly what the practices were.

k) How important is it to maintain these traditional practices in your new place of residence ? Why ?

Return to asking all respondents here:

87. How far do you have to travel to visit an ante-natal care clinic ?

88. How important is distance in deciding if you are to use ante-natal care ? Why ?

89. Approximately what is the total cost of antenatal care for your last pregnancy ? Probe to find out if this was considered excessive.

90. What would consider to be the most important factor when deciding to use ante-natal care ? If more than one factor given, probe to find which is the most important and why.

91. Were the services used during your last pregnancy your first choice of service ? If not, which service would you rather have used? Why were you unable to use this service?

Section Five: Knowledge of Services:

92. What type of health service do you use: government, private or some other type ? If other, please describe.

93.If not using government service: Are you aware that government services are available?

94. Why do you not use government services ?

95. Is the service you use the nearest to you ? If NOT, What type of service is your nearest health service ? Why do you not use this one ?

96. How did you find out about the health service you use ?

97. How long does it take you to travel to this service ?

98. How long do you usually have to wait to see a doctor at this health service ?

99. What are the opening hours of your nearest health service ?
Probe to find out of the respondent feels these are adequate. If NOT, then when would they like to be able to visit the health service ?

100. Why have you chosen this type of health service ?

101. Whose decision is it to use this type of health centre. Why does this person make the decision ?

102. Do you feel the service you use could be improved ? If Yes, how ?

103. Please ask if any of the following services are available in the area, how far away are they, does the respondent use the, and how did they find out about them. Fill in table.

Service	Distance	Do you use	Source of info	Private or Govt
Child vaccination				
Antenatal care				
Treatment of common illnesses				
Emergencies				
Child delivery				
Other				

104. Are there any health facilities that you think need to be provided in your area ?

Section Six: Child Health: Return to asking all respondents.

105. For each of the children born please fill in the following table, detailing the vaccinations that each child has received, the age at which they received them.

Child	DPT	Polio	BCG	Measles
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

In each cell indicate whether the vaccination was received, at what age, and the number of doses.

106. Where did your last child receive their vaccinations ?
Probe to find out what type of service was used.

107. Have any of your children had any major illnesses in the last two years ? Probe to list the illnesses of each child.

108. What health services do you use for your children ?
Probe to find out where the services are, and what type they are (Private/ Govt).

109. If your child was seriously ill would you take them to the hospital ?
If YES, how far away is the hospital ?
If NO, Why not & what treatment would be given to the child?

110. Whose decision is it when deciding which health services to use for the children in your family ?If it is not the woman's decision, why does that person make the decision ?

111. If you felt that your child was sick enough to need hospital care and somebody else in your family told you it was not necessary would you question that person and take the child anyway ? If NOT, why not ?

112. What do you believe are the main causes of child illness in your area ?

113.Do you think that there is anything you can do to prevent child illness ?

114. How important is the advice of your kinsfolk in helping with the health care of children ? How is it important ?

115. In general, what causes a person to become ill ? Probe for many reasons.

116. What services do you use for your own health care needs ?

117.Whose decision is it for you to use these services ?Why does this person make the decision?

118. Do you go alone to the health centre ? If NOT, Who goes with you ?

119. If you are sick who takes over your household duties ?

120. Do you receive any extra help with duties when you are sick or pregnant ? If YES, what help and by whom ?

121) Migrants (ask only to migrants)

a) What type of health service did you use for treatment of a common illness in your previous place of residence ?

b)Why was this type of service used ? Probe for the most important reason.

c) Whose decision was it to use this service ? Why did this person make the decision ?

d) Do you think that the services here are an improvement on those in your previous place of residence ? If YES, How ? If No, Why not ?

e) What do you feel are the main differences between health services here and in your previous place of residence ?

Section Seven: Female Autonomy:

122. Do you work outside the home ?
If YES, what type of work are you employed in ?

123. How far do you travel to work ?

124. Do you take your children to work with you ?
If NOT, who looks after your children whilst you are at work ?

125. Is your income pooled with that of the rest of the family?

126. How is your income used ?

127. **MIGRANTS: Ask only to migrants**

a) Did you work outside the home before you moved to your present place of residence

b) If YES, what type of work were you employed in ?

c) Did moving here change your need to work outside the home ? If YES, how ?

d) Was your decision to migrate influenced by work, either your own or someone else from your family, if so, how ?

Return to asking all respondents:

128. Do you have property or land in your own name ?
If YES, do you have the freedom to spend your land or property in your own way ? If not, who decides and why ?

129. Does your husband allow you to work in any kind of occupation if you chose ?

130. Who makes the decision about the allocation of resources in the household ? Why does this person make the decision ?

131. Are economic decisions made jointly in your household or by one person ? If so, who ?

132. How important is it to educate boys ?
If they feel it is important and their own boys are not in school, ask why they are not in school.

133. How important is it to educate girls ?
If they feel it is important, and their own girls are not in school, ask why they are not in school.

134. Can you go alone to the market if you chose ? If not who goes with you ?

135. Can you go alone with your children to the health services? If not who goes with you ?

136. When deciding upon the number of children you give birth to who makes the decision in your household ? Why does this person make the decision ?

137. What would be your ideal family size ?

138. What would be your ideal number of boys ?

139. What would be your ideal number of girls ?

140. How important do you believe it is to have a son ? Why

141. How important do you believe it is to have a girl ? Why ?

Thank you for your participation in this interview. the results will now be used as data for my PhD studies in England. I would like to stress that all the information you have given is totally confidential, and will only be presented in a way that ensures your confidentiality.

Thank you.

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