University of Alberta

Social Determinants of Infant Mortality in Nepal

by

Juhee Suwal

A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfillment of the requirements for the degree of Master of Arts

in

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October 3, 1996

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Faculty of Graduate Studies and Research

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled Social Determinants of Infant Mortality in Nepal submitted by Juhee Suwal in partial fulfillment of the requirements for the degree of Master of Arts in Demography.

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Date: Sept 12/96

Dedication

This thesis is dedicated to my late parents who were my inspiration and who served the poor and the nation till their last day of life.

Abstract

Infant mortality is a sensitive human development indicator of a nation. Infant mortality has reached a stable low rate in developed countries while it is still high and on a slow decline in developing countries. There are many factors which contribute to the incidence of a high or low level of infant mortality. Although credit for contributing to the lowering of infant mortality has been given to health programmes by public health personnel and to the improvement in socio-economic status by social scientists, in a traditional and agricultural country like Nepal, both these factors are found to influence infant mortality. Data on infant mortality obtained by the 1991 Demographic Health Survey of Nepal are analysed in this study. A logistic regression model is used for analysing the data. Several hypotheses are set up to explain the incidence of infant mortality in Nepal. All the hypotheses are supported. The various reasons for the persistence of high infant mortality and the difficulties in lowering it are discussed.

Acknowledgement

It has been my pleasure to work and discuss my research with my committee members. My special thanks go to my supervisor, Dr. P. Krishnan, who inspired and co-operated with me in every phase of the writing. I am indebted to my cosupervisor, Dr. N.M. Lalu, for his enduring guidance in completing the statistical analysis, and I appreciate his untiring co-operation.

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INTRODUCTION

Nepal is a landlocked country with a total land area 147,181 square kilometres and with nearly 18.5 million people (census, 1991). It is situated at an altitude of 160 to 8839 meters between India and the autonomous region of Tibet (see figure 1). Nepal is divided into three geographical regions: the northern mountains (Himalayas), central hills, and southern Terai. The country is further divided into five development regions for government administrative purposes (see figure 2). They are: eastern region, central region, western region, mid-western region, and far western region, and they include 75 districts, 36 municipalities, and 4,012 village development committees (VDCs). The population densities in the three ecological regions, namely mountains, hills and Terai are 28, 137, and 253 persons per square kilometre, respectively.

About 91 percent of the population resides in the rural areas and subsists on traditional agriculture. Though a small country, Nepal has 75 major ethnic groups, speaking more than 30 different languages and 50 dialects. About 65 percent of Nepal's land area is comprised of hill regions. Much of Nepal falls within the monsoon climate area. Four types of climate prevail in the country: humid tropical, moist subtropical, temperate to cool temperate, and Alpine and arctic. It is estimated that 21 percent of Nepal's land area is cultivated. Forty-two percent of the land area is covered by forests, 12 percent by pastures and grasslands, and 25 percent by other uses (ICIMOD, 1992). The following statements will provide us with a better understanding of the reasons for slow development in Nepal.

> Nepal's landlocked situation and the predominance of rugged mountainous areas have made the development of transport and communication extremely difficult. Despite these difficulties, some breakthroughs have been made in the development of infrastructure. However, even today, a large part of the country remains inaccessible by modern transport and communication means.
> (NPC/HMG, UNICEF 1992: 6)

> Having never been colonized and having had a relatively cohesive national identity since the late 1700s, Nepal is rather unique amongst the nations of the region. It is fair to say that one of the strengths of the country is its internal stability and its strong sense of self, which has enabled it to hold a precarious balance between powerful neighbours and against the more overt ambitions of potential colonizers. The price for this, however, was paid in isolation at a critical stage of world development and the deliberate under-development of the country by a ruling elite until the early 1950s.
> (NPC/HMG, UNICEF 1992: 3)

Figure 1
Location of Nepal

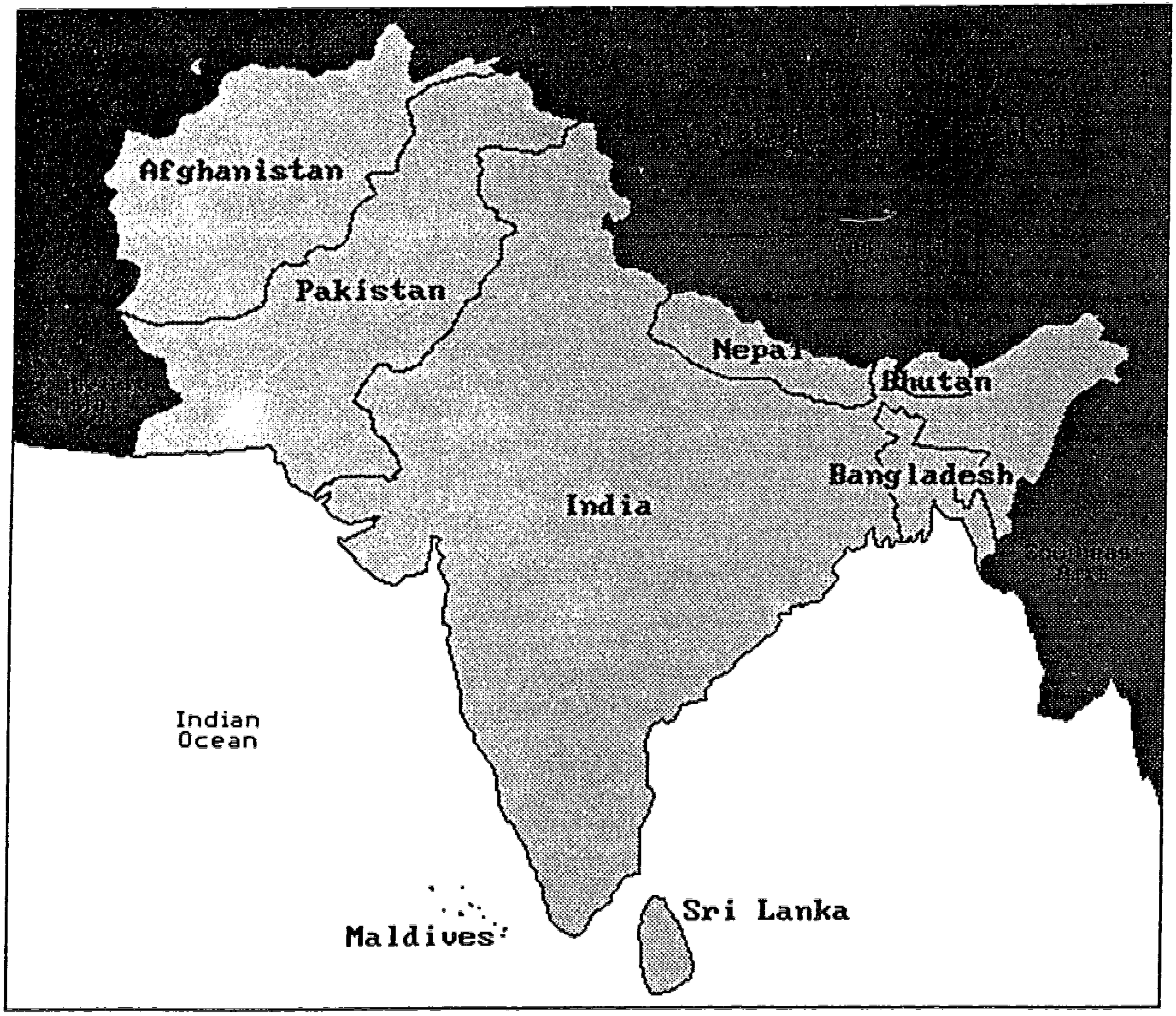
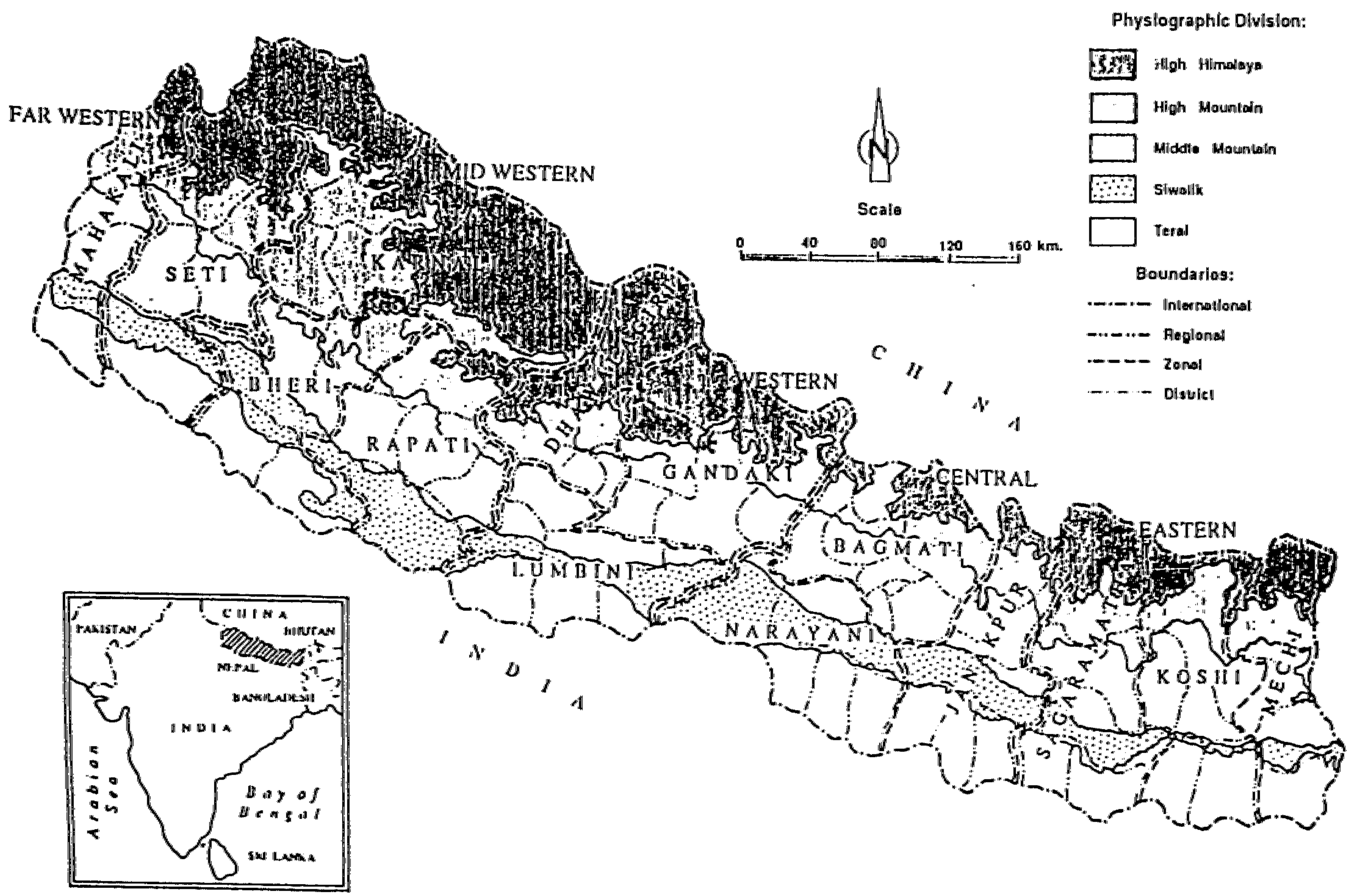

Afghanistan
Pakistan
Nepal
Bhutan
Bangladesh
India
Indian Ocean
Maldives
Sri Lanka

Figure 2
Nepal


FAR WESTERN
MID WESTERN
WESTERN
CENTRAL
EASTERN
MAHAKALI
SETI
KARNALI
BHERI
RAPATI
DHAULAGIRI
GANDAKI
LUMBINI
BAGMATI
NARAYANI
JANAKPUR
SAGARMATHA
KOSHI
MECHI
CHINA
INDIA
N
Scale
0 40 80 120 160 km.
Physiographic Division:
High Himalaya
High Mountain
Middle Mountain
Siwalik
Terai
Boundaries:
International
Regional
Zonal
District
CHINA
PAKISTAN
BHUTAN
NEPAL
BANGLADESH
INDIA
Arabian Sea
Bay of Bengal
SRI LANKA

The demographic statistics of Nepal reveal its under-developed condition and the demographic transition is very slow. However, the infant mortality rate (IMR) has dropped from 172 per 1000 live births in 1971 to 97.5 in 1991. The major demographic statistics for the census year 1991 are given below (Table 1).

TABLE 1
SOCIO-DEMOGRAPHIC INDICATORS FOR NEPAL

		1991 Census[a]	PRB 1995[b]
Population:	Total	18,491,097	22.6 (millions)
	Male	9,220,974	
	Female	9,270,123	
Population under 1 year:			
	Total	565,413	
	Male	287,551	
	Female	277,862	
Population growth rate per annum		2.1 %	2.4 %
Crude birth rate		41.2	38
Crude death rate		13.3	14
Total fertility rate		5.6	5.8
Infant mortality rate		97.5	102
Life expectancy at birth		54.3	54
Literacy rate:	Total	39.6%	
	Male	54.5%	
	Female	25%	
Urbanization [1]		9.2%	10%

Sources: a. Central Bureau of Statistics (1991 census), Kathmandu
b. Population Reference Bureau (PRB) Inc., World Population Data Sheet, 1995.

The infant mortality rate is a good and sensitive indicator of the development of a nation. This sensitive indicator is influenced directly and indirectly by a number of factors. In difficult situations, adults and elderly people may be able to survive better than infants. Infants are the most dependent with the least immune power to cope with the environment. For this reason, infants are affected the most by the availability of health facilities, life style of the family, affordability of good food, sanitation, etc. The survival or the death of infants, thus, becomes a sensitive measure of the development of a nation.

There has been a debate for many years among demographers and public health scientists about the contribution of socio-economic development and the medical facilities provided by the public health programmes in the reduction of mortality (Arriaga and Davis, 1969; Preston, 1975; Caldwell, 1979). In Sri Lanka, 23 percent of the total national post-war decline of mortality had been accredited to malaria control (Gray, 1974). Frederiksen (1968) had a different view of the dramatic decline in Sri Lanka's mortality rate in 1946. He provided evidence that economic development, by increasing per capita food consumption, was an important factor. On the other hand, the control of infant mortality through widespread education programmes, contributing to an increase in literacy among women and health consciousness, is believed to be the major factor in the reduction of mortality in the State of Kerala, India (Nayar, 1985). In developing countries, infant mortality accounts for a relatively higher proportion of all deaths whereas in the developed countries, it represents an increasingly small segment of total mortality (Klinger, 1985). Furthermore, "Lower infant mortality means that fewer children need to be born to achieve a certain number of surviving" (Weeks, 1994: 77). Thus, infant mortality has a big role to play in the demographic transition of a nation. Lower infant mortality has certainly contributed to the present demographic transition of low mortality and fertility in the developed nations.

In a country like Nepal where social norms are complex, socio-economic status low and medical facilities out of reach for most of the population, the socio-economic factor or the public health programme alone may not explain the slowness in reduction of infant mortality. In the case of this country, these factors indeed are interrelated to one another and both have an impact on infant mortality.

Infant Mortality Rate

The infant mortality rate is defined as the number of deaths to infants under one year of age per 1000 live births in a given year. In a life table, it is denoted by q_0 and is defined as the probability of dying during the first year of life. Among all the population subgroups, infants under one year of age are subject to much greater death risks than persons at any other age except the elderly (60 and over). As death rates above age 65 have a much smaller effect on expectation of life at birth than infant mortality, it is clear that the number of deaths that occur during the first year of life will strongly affect life expectancy at birth (Bogue, 1969). Low and high levels of infant mortality are the major reasons for achieving life expectation as high as 78 years and as low as 42 years at birth. Bogue has noted, "Great success has been achieved in reducing infant mortality by means of public health and medical discoveries" (1969: 559). As mentioned earlier, the infant mortality rate is a strong human development indicator of a nation.

For research purposes, infant mortality is divided into three components: perinatal, neonatal and post-neonatal. Neonatal mortality refers to deaths occurring in the first 28 days of birth, perinatal mortality includes late fetal deaths and deaths within seven days, and post-neonatal mortality refers to deaths after 28 days up to one year. As newborns are breastfed and protected from the environment and the risk of accidents in the first days of life, the majority of infant deaths would be post-neonatal. Thus, when medical care is less available, post-neonatal deaths would exceed neonatal deaths. On the other hand, in societies where medical care has achieved low death rates, it is the post-neonatal deaths that have been reduced the most. This results in a majority of all infant deaths being neonatal, caused by physiological and organic weaknesses (Bogue, 1969), of which the most severe cases succumb to death in the early neonatal stage.

The infant mortality rate of Nepal is very high at 97.5 (1991 census). Infants comprise 3.1 percent of the total population; that is, 565,413 out of 18,491,097 people. Current estimates from various surveys show that as many as 49 percent of all infant deaths occur in the neonatal period, and a little less than half of these occur in the early neonatal stage (NPC/UNICEF, 1992). Quite contrary to Bogue's thesis noted above, the high percentage of neonatal deaths in Nepal is not due to reduction of post-neonatal deaths with more health-care availability, but due to causes such as congenital abnormalities, prematurity, birth injuries, tetanus infections, and low birth weight (ibid.). In the post-neonatal stage, the most prominent causes of death are acute respiratory infection[2] and diarrhea. Tables 2 and 3 present a short time series of the infant mortality rate in Nepal.

TABLE 2
INFANT MORTALITY RATE BY SEX, NEPAL,[3] 1954 TO 1991

Source	Period of Estimate	Infant Mortality Rate Per 1000 Live-births		
		Both Sexes	Males	Females
Vaidyanathan and Gaige, 1973	1954	-	260	250
Worth and Shah, 1969	1965-66	152	-	-
Gubhaju, 1974	1961-71	-	200	186
Central Bureau of Statistics, 1974	1971	172	-	-
Demographic Sample Survey, 1976	1974-75	133	141	123
Demographic Sample Survey, 1977	1976	134	128	138
Demographic Sample Survey, 1978	1977-78	104	110	98
Nepal Fertility Survey, 1977	1976	152	-	-
Gubhaju, 1984	1973-74	171	-	-
Central Bureau of Statistics, 1985	1978	144	147	142
New Era, 1986	1981	117	136	111
Fertility and Family Planning Survey, 1986	1983-84	108	117	98
Demographic Sample Survey, 1987	1986-87	107	-	-
Nepal Fertility, Family Planning and Health Survey, 1991	1989	98	105	91
Population Census, 1991	1991	97	94	101

Source: Population Monograph of Nepal, 1995, pp106, National Planning Commission Secretariat, CBS, Kathmandu

TABLE 3
INFANT MORTALITY BY URBAN-RURAL RESIDENCE, NEPAL 1962-1991[4]

Source	Infant Mortality Rate Per 1000 Live-births		
	Period of Estimate	Urban	Rural
Nepal Fertility Survey, 1976	1962-71	127.0	167.0
Demographic Sample Survey, 1976	1974-75	57.1	134.8
Demographic Sample Survey, 1977	1976	52.8	136.1
Demographic Sample Survey, 1978	1977-78	67.2	105.1
Nepal Fertility Family Planning Survey, 1986			
(Direct Estimate)	1982-85	63.0	97.0
(Indirect Estimate)	1982-83	56.0	111.0
Demographic Sample Survey, 1986-87	1986	82.1	110.6
Nepal Fertility Family Planning and Health Survey, 1991			
(Direct Estimate)	1981-91	60.4	100.2
(Indirect Estimate)	1989	69.0	105.0

Source: Population Monograph of Nepal, 1995, pp 113, National Planning Commission Secretariat, CBS, Kathmandu

It is clear from these data that the infant mortality rate shows a declining trend. A similar trend is noticed for infant mortality by gender as well as by rural and urban residence. However, in the rural/urban case, the trend is not consistent. In the context of South-Asian countries, the estimated values of socio-demographic indicators for 1995 (Table 4) show that the position of Nepal is somewhere in the middle.

TABLE 4
SOCIO-DEMOGRAPHIC INDICATORS FOR SOUTH ASIAN COUNTRIES, 1995

Country	Population (millions)	Natural increase (%)	IMR	TFR	Life expectancy at birth	(%) urban
Bangladesh	119.2	2.4	108	4.3	55	17
Bhutan	0.8	2.3	138	6.2	50	13
India	930.6	1.9	74	3.4	60	26
Maldives	0.3	3.6	52	6.2	67	26
Nepal	22.6	2.4	102	5.8	53	10
Pakistan	129.7	2.9	91	5.6	61	32
Sri Lanka	18.2	1.5	19.4	2.3	75	22

Source: Population Reference Bureau, Inc. (PRB), World Population Data Sheet, USA.

Among the seven regional countries, Nepal has the lowest percentage of urbanization. The infant mortality rate of Nepal is lower than that of Bangladesh and Bhutan but higher than the others. Strong disparities are seen among these countries. Sri Lanka experiences only 19 infant deaths per 1000 live-births; Bhutan 138 deaths. A baby born in Sri Lanka may expect to live 75 years while one born in Bhutan 50 years. The negative correlation between infant mortality and life expectancy at birth is clear from the data.

Population scientists regard infant mortality as being caused by endogenous and exogenous factors. Endogenous factors such as birth injuries, congenital disorders, immaturity, and postnatal asphyxia are the main causes of neonatal deaths and dominate the early neonatal stage whereas exogenous factors or environmental factors such as infectious and parasitic diseases, and accidents, dominate the post-neonatal stage. Endogenous causes have a biological character and are not preventable as such, whereas exogenous causes are usually preventable and treatable (Shryock, 1976). However, the endogenous causes are preventable only if the prevention is focused on maternal health and obstetrical care. Both endogenous and exogenous factors overwhelmingly affect infant mortality in Nepal. Thus the purpose of this study is to analyze the determinants and consequences of the infant mortality rate in Nepal.

Plan of Thesis

The thesis is planned as follows. The theoretical bases for the determinants of infant mortality are presented in chapter 2. The factors selected as determinants are socio-economic, health related, demographic, and life-style related. In chapter 3, several international and national literatures on infant mortality are reviewed. The source of data, survey design, statistical model, measurement of data, research objectives and hypotheses are explained in chapter 4. In chapter 5, results of analysis are given.

Logistic regression is used to analyze the data. The analysis is done in two sections: first with logistic regression of each independent variable separately; the second with logistic regression controlling for all remaining variables. Chapter 6 contains a summary and interpretation of the results, concluding remarks, policy implications, limitations of the study, and suggestions for future research. Relevant appendices are presented at the end.

CHAPTER 2

DETERMINANTS OF INFANT MORTALITY: THEORETICAL BASES

There are many factors which affect infant mortality rate, and these vary between the developing and the developed countries. The major factors that affect infant mortality rate in Nepal are presented below.

Socio-economic Factors

Mother's Education

There is no doubt that higher levels of mother's education result in lowering infant mortality. Education also has a role to play in influencing other determinants of infant mortality. The knowledge gained through education will enable mothers to have a greater awareness of sanitation, and a more hygienic way of living, eating and feeding nutritious food, and to use more health care facilities. Along with improved skills and self-confidence, educated women tend to marry late, use family planning devices, take up jobs (consequently earn more money); and they are more exposed to media and information. They may break traditional rules which have an adverse effect on infants. Caldwell (1979) found lower mortality not only when a mother was educated but when she was herself reared in a modern, urban-elite household. He explained how an educated woman may fight traditional practice to care and save her infant's life:

> A woman with schooling is more likely to challenge her mother-in-law, and the mother-in-law is much less likely to fight the challenge. ...She

> is more likely to attempt to communicate with her husband, and her husband is less likely to reject the attempt. (Caldwell, 1979: 412)

Since it is mothers who actually take care of infants, the low literacy rate of women (25% in Nepal) is responsible for high infant mortality to a great extent. An educated mother is more likely to know where the right facilities are, to regard them as part of her world, and to regard their use as a right and not a boon (ibid.).

Occupation of Mother

Occupation of mother is related to her educational and family background. Traditionally Nepali women have engaged themselves in agricultural work, in small businesses like manufacturing handicrafts, and clay potteries; in making and selling of herbal and Ayurvedic medicine; in selling meat, milk, sweetmeats, flowers, fruits, and bangles; and in cottage industries like hosiery, carpets, and bronze and stone carving which are owned by the families. The hiring of female labourers from outside the family for some of the above-mentioned work, was practised only two to three decades ago. At present, ninety percent of the women are in agricultural occupations; the remaining 10 percent are involved in professional, technical, sales, production, etc. (CBS, 1995). Among these women, 0.4 percent are employers, 11.9 percent are employees, 83.7 percent are self-employed, and 3.5 percent are unpaid family workers (ibid). Almost all the professional women are from urban areas and from well-to-do families (NPC/UNICEF, 1992: 92,93). The participation of women in the labour force may affect infant mortality rate in a positive or negative way.

The inverse effect may be due to higher income as an outcome of their jobs while the positive influence, due to lack of care, less frequent breastfeeding, etc.

The study by Shrestha et. al. (1987) showed a strong positive association between female labour participation and infant mortality. How female labour force participation affects infant mortality in Nepal may not be easy to assess because of the country's varied cultural, socio-economic, and regional background. While the income of working mothers may have a direct impact in reducing infant mortality as they are likely to spend most of the income on their children; at the same time, the social status earned through jobs may affect infant survival indirectly as family members may treat these women and their children in a more respectful manner. In addition, working outside of the home provides greater opportunities for interaction with different people and different media, and provides access to up-to-date information on different topics including health and child care. On the other hand, non-agricultural occupations also mean less time spent at home, consequently less care of infants, infrequent breastfeeding, all of which could have adverse effects on their well-being.

Family Income

Income of the family is another important determinant of infant mortality. Accessibility to a doctor, hospital, good food, and sanitation depends not only on availability but also on affordability. For better-off people and high income groups, infant mortality rate may be low. Higher family income means better housing conditions and a higher standard of living since rich people are more likely to live in bigger houses built far away from crowded localities, and they are more likely to spend more on good food and health facilities, etc. Parents in high income families may have less anxiety and more time to care for infants as they are more likely to hire cooks and house servants. Since, higher income families can afford every facility a newborn needs, infants have a greater chance to survive in these families. But since 90 percent of the people in Nepal still rely on agriculture for their subsistence and live in rural areas, their family income is low. Thus low family income seems to adversely affect infant mortality in Nepal the most.

Residence

About 91 percent of the population in Nepal resides in rural areas. Unlike in developed countries, the polarization of rural and urban living conditions, and of rich and poor, is very distinct in Nepal. In the Terai, the disparity between the rich landlords (who rarely live in the villages) and the poor landless farmers can be noticed even today. The rural people in Nepal are deprived not only of all modern facilities but also of basic necessities. Even the basic necessities such as clean water, good toilets, etc. are scarce in the remote rural areas.

In comparison with the developed countries, the situation of infant mortality may be just the opposite in Nepal. In the nineteenth century, urban mortality (including infant mortality) was much higher than rural mortality in developed countries. The spread of infectious diseases due to overcrowding, an inadequate water supply, and an inadequate sewage disposal system contributed to higher urban mortality (Gubhaju, 1991). This situation may also occur in some parts of developed countries even today. Like other developing countries, rural-urban infant mortality differential in Nepal is opposite to that of the developed countries, with rural areas having higher mortality.

Although chronic starvation is not a problem and slums are rare in Nepal, the lack of infrastructures, basic health care facilities, and poor and unsanitary housing conditions are life threatening to the infants in rural areas. Apart from these, the low literacy rate of mothers, low family income, etc. adversely affect the situation all the more. On the other hand, urban areas where every modern facility is available would certainly contribute to lower infant mortality.

Religion

Three main religions, namely Hinduism, Buddhism, and Islam, are practised in Nepal. Hinduism, currently at 86.5 percent, has been dominating the country for more than a century. Although, "At one time Buddhism was the predominant religion of Nepal" (Northey and Morris, 1928: 74), Buddhists, currently at 7.8 percent only, are located in Kathmandu, Himalayas, and in some hilly regions. Muslims[3], 3.5 percent of the total population, are concentrated in the Terai region; some reside in Kathmandu and hilly regions.

The different norms and beliefs of these religions may play a significant role in shaping infant survival and maternal health. The dilemmas and beliefs of some orthodox religions may encourage families to have more babies, avoid nutritious food (especially during the postnatal stage), refrain from seeing a doctor, etc. Muslims, for example, marry earlier than do the members of other religious groups; and they have much lower socio-economic status (e.g. only 11 per cent of the females are literate) than others (Appendix 1). Polygamy is allowed in Islam. Moreover, most of the women are still confined to home.

Ethnicity

Nepal is a culturally diverse country with many ethnic groups. The ethnic groups range from the orthodox groups like Brahmins and Chhetris to the very liberal groups like Limbus and Magars. There is an ethnic group known as Newar which, many scholars and researchers argue, could not be considered merely as an ethnic group, since it has many ethnic groups within itself. And there still exist untouchable ethnic groups who are deprived of modern facilities and development processes. Thus the varied and diverse economic and social conditions of the different ethnic groups may affect infant mortality in Nepal.

The different traditions and cultural practices, and the socio-economic backgrounds of the diverse ethnic groups certainly affect the health and living standard of the people. The impact may indirectly affect infant health. When a baby is born, it has the same chance of survival irrespective of its ethnicity. But the social and cultural bondage to which it is born, starts to interfere with its freedom to live the day it is born. The family and its surroundings influence the survival of the infant.

Most Brahmin girls in the rural areas are married at an early age of ten or eleven while most Chhetri girls are married only when they are fully grown. In addition, a daughter-in-law has a completely different status in her husband's house than in her parent's house (Bista, 1967). Newar women, on the other hand, are more liberal than Brahmin and Chhetri women. The mountain dwellers like Sherpa, Limbu, Magar, Gurung, Rai, Tamang, and Thakali (Mongoloid groups) women are the most liberal ones socially and economically. They marry late and are free to choose their spouses. Dating, divorce, and remarriage are not taboo for them. These women have their own funding resources. They have more power at home than men do and are household heads in many cases, because many of the men from these ethnic groups serve in the British Gurkha Army, the Indian Army, etc. outside the country. Men do not interfere in the social activities of women. These women participate freely in the village fair or any customary singing and dancing with men for the whole night. When one examines the literacy rates, Thakali women are the most literate (51%) followed by Newars and Brahmins (48% and 47% respectively) and other Mongoloid groups (except for Tamang women of whom only 16% are literate) (Appendix 1). Muslim women are the least literate. These factors may affect the survival of infants.

Although the ethnic groups are scattered all over the country, generally speaking, Brahmins and Chhetris live in the hills, the Mongoloid groups in the hills and mountains, Newars in Kathmandu valley, and Muslims, Tharus, Satars, etc. in the Terai. It is worth mentioning that although Newars migrated to several parts of the country some decades ago for trade and business purposes, they are rarely found in the remote areas.

The eating habits and food consumption patterns are also different for various ethnic groups. It is noteworthy that Newars give high priority to food. They are very famous for the different varieties and the nutritious food they consume. Apart from being famous for their arts and artisans, and handicrafts, Newars have many festivals and rituals in which food is given the highest importance. Whether it is festival or feast or daily food, their menu is always well balanced. Also, whether rich or poor almost all Newars participate in festivals and rituals. In general, their daily food consumption includes three to four meals a day. The special attention to food consumption, may affect infant mortality indirectly.

Health Factors

Nutritional Status

Nutrition is "the process by which the organism uses food...for purposes of maintenance of life, growth, normal functioning of organs and the production of energy" (McLaren, 1976: 3). Nutriture is "the state resulting from balance between supply of nutrition.....and the expenditure of the organism" (ibid). Nutritional status is "the expression of nutriture in a specific variable" (Habicht et al., 1979: 366).

Malnutrition is "an imbalance of specific nutrients in the diet: for example, the diet may be deficient in proteins, vitamins, or fats" (John, 1993: 373). Undernutrition refers to "the calorie inadequacy of a diet: the diet may be relatively well balanced, but there is simply not enough food" (ibid).

Nutritional status of both infants and lactating mothers plays an important part in the lives of infants. Good food eaten by mothers helps to produce quality milk for the infant, thus maintaining health and increasing chances of survival. Along with mother's milk, infants need other nutritious solid food after they are four months of age. It has been estimated that about 36 percent of the population in Nepal consumes less than the minimum recommended calorie intake. In addition, infectious and parasitic diseases which have strong adverse influences on nutritional status are highly prevalent in Nepal (NPC/UNICEF, 1992). Survey reports have shown that anaemia among pregnant and lactating mothers is prevalent in Nepal, and as a consequence, the weak and unhealthy infants may succumb to death.

This may be related to the eating habits of the people, especially the poor and those in remote areas. The food consumed by the people contains more grain and cereals than vegetables. In the Himalayas, green vegetables are not grown. Even in the hill regions, green vegetables are rare. People in the hills are more interested in cash crops or cereals which will last for the whole year. The eating habits thus affect the infants in a negative way, both through mother's poor nutrition consumption, resulting in low quality milk, and the unbalanced solid food the infants consume after they are four to five months old. A study done on developing countries made the following speculation.

> Children from poor rural areas may start life with an adequate birth weight and achieve normal growth in the first six months. Subsequently, however, an almost exclusively starch-based diet,

> introduced at the time of weaning, no longer meets their nutritional requirements nor can the child absorb the bulk required to give adequate nutrition. Such children are apt to develop nutritional deficiencies which render them vulnerable to intestinal and respiratory infections and to malaria. (Talamanca, 1984: 144)

However, the Nepal Health Survey (1965-66) reports an adequate nutritional status even in the villages.

> In spite of the generally unsanitary village environments at that time, the survey found that the nutritional standard of Nepal's population in the villages surveyed appeared to be adequate (Worth and Shah, 1969: 107). The quantity and variety of food available provided enough calories for the people, through a predominantly grain diet. Protein came mostly from several grains combined with beans or lentils, with various vegetables, and with occasional high-protein sources like eggs, meat, or milk from animals (the latter two usually from goats or cows) owned by almost every rural family. (Banister, 1981: 30)

Prenatal Care

This factor is very important in saving the lives of both mothers and infants. For many reasons (e.g. lack of hospitals and gynaecologists, distant location of health posts) the rural people do not have the necessary adequate prenatal care. Prenatal care is not a traditional practice in Nepal. In rural areas women are still not encouraged to seek prenatal care, due to cultural modesty (NPC/UNICEF, 1992). Moreover, lack of female "Village Health Workers" and female staff in the village health posts, make women reluctant to visit medical centres.

When pregnancy complications arise, women with uneducated and rural background may first seek the assistance of faith healers rather than medical or trained birth attendants. Even among the educated women, herbal/Ayurvedic medicine is more popular than modern medicine during pregnancy. However, the *Vaidyas*[4] (Ayurvedic practitioners) may not be able to detect the internal causes of pregnancy complications.

As Nepali women are shy about discussing pregnancy, mothers and mothers-in-law are the most likely persons to learn of the situation early. One reason for this is that mothers are inquisitive about their daughter's pregnancy and in Hindu families, mothers-in-law usually know a daughter-in-law's menstrual cycle (the menstruating period is considered as polluting and menstruating women are kept away from the kitchen, cooking, touching men, and particularly religious rituals). As the extended family system still exists in Nepal, particularly in rural areas, a mother-in-law plays a large decisive role in family matters, especially related to daughters-in-law (Thapa, 1993). A project conducted to train and educate mothers-in-law about the "knowledge, attitude, and practice" concerning intra-conceptional care speculated:

> Of several factors associated with non-utilization of the existing maternal health services, prohibition by mothers-in-law is one. ...Many mothers-in-law still consider pregnancy as a normal phenomenon, not requiring any check-up unless there is a severe problem.
> (Thapa, 1993: 110)

Women in high caste[5] families are fed last and eat last. Despite this fact, in most of the families pregnant women, especially in the Newar ethnic group, get special treatment to the extent of their ability. Foods which may cause constipation, very hot and mouth irritating spices like chili, *tebu* (or *timur* which is believed to develop epilepsy in the baby), and alcohol, cigarettes, and drugs are prohibited during pregnancy. The prohibition of drugs may lead to lower use of tetanus toxoid vaccine, which is a boon to the tetanus prone rural surroundings. In some families, pregnant daughters-in-law are assigned heavy work after the earlier (critical) three months as continuous heavy work is believed to make delivery easy. On the other hand, some families curtail all kinds of heavy work for pregnant women so that the mother and baby will be safe.

Lack of proper prenatal care may lead to low birth weight and weak and unhealthy newborns, etc. Prenatal care includes nutritious food for mothers, maintaining good health and refraining from smoking and drinking, apart from a doctor's advice and supervision.

Postnatal Care

Postnatal care is essential for infant survival. Breastfeeding, feeding nutritious solid food, timely immunization, sanitation and a hygienic way of living are vital in preventing possible post-neonatal deaths.

After staying securely in the mother's womb for nine months, when a newborn baby struggles to survive in its new surroundings, it becomes the duty of the family members to create a suitable environment for the infant. In Gorkha villages of Nepal[6] premature newborns died simply because the mother did not know how to keep them warm enough for survival in winter. Another reason was that the babies were not able to suck the mother's milk in such situations. Thus the premature babies cannot survive in the villages where modern health technologies and equipment are unavailable.

Clean and hygienic surroundings and precautionary measures such as different immunizations become crucial for the survival of the baby. For a rural based country like Nepal, immunization such as tetanus toxoid is essential as household and agricultural (e.g. sickle) equipment are used in cutting the cord of the baby. Mosley wrote, "In a rural setting where people are in close contact with animals and where manure is used in the fields, and in particular where cow dung is used to plaster the floor and walls of houses, and as a fuel, neonatal tetanus will be more prevalent." (Mosley, 1985: 122)

Until 1985, immunization coverage was limited to a small proportion of the eligible population, often at the district headquarters or surrounding health institutes. Immunization in most parts of the country was carried out by travelling teams of vaccinators, employed under the "Expanded Programme on Immunization" (NPC/UNICEF, 1992). In 1986, a household survey of 4,500 families found that more than 50 percent of the children aged six to 36 months were not immunized (ibid.).

Food is consumed for survival rather than for its nutritious value and saved for family and/or community rituals in most parts of Nepal. Nutritious food for the lactating mother and the baby after four months of age is very important in promoting good health of the infant. The unbalanced diet given to the new mother and lactating mother may not necessarily be due to poverty but may be due to ignorance of food values. These are some of the factors which affect infant mortality adversely.

On the other hand, irrespective of economic status, in most ethnic groups, a new mother is cared for with special attention for at least one to two months. She usually stays at her maternal home during this period, where she is fed special food, three to four meals a day instead of the usual two to three meals. However, in remote areas if the maternal home is very far (e.g. from one village to another), women do not go to maternal homes and their postnatal care depends on the mercy of mothers-in-law. Certain foods are forbidden during this period. Fruits, green vegetables, pumpkin, hot spices and gas forming food like black lentils, dry beans, peas, roasted food, milk and eggs are on the taboo list for a few weeks. Heavy work may be restricted. However, in the Himalayas and in those (rural) families where humanpower is less available, new mothers have to resume their work within a few days. In the Kathmandu valley and in some other places, among particular ethnic groups like Newars, Maithils, etc., oil massage to the baby and the mother is done twice a day for four to twelve weeks after birth. Moreover, professional women and other job holders get six to eight weeks of delivery leave. These practices may help in lowering infant mortality.

Place of Delivery

About 85 percent of births still take place at home in Nepal. In the Hindu society and among the Buddhists in the hills and Kathmandu, birth is seen as ritually polluting, and the birth place, thus becomes polluted (Levitt, 1988). The delivery place and the members of the house are purified within four days to two weeks (according to ethnic rituals and the health of the mother) when the house is cleaned and the baby, its mother, and the whole family are given a ritual cleaning. In the remote areas of hills and mountains among the Parbatiyas (Brahmins and Chhetris), traditionally, births may take place in an animal shed (where women also spend the days of their monthly menstruation), and in most of the ethnic groups in the Terai, in a dark room with a fire burning outside the door to keep the evil spirits out (ibid.). One interesting finding is that rural women prefer to give birth at home with the assistance of husbands and relatives even if hospitals are available (ibid). These traditional delivery places and the deliveries in hospitals certainly would have a substantially different impact on infant mortality.

Delivery Assistance

Traditional birth attendants have been helping in home deliveries for generations; others who assist deliveries are female relatives, female neighbours, and mothers-in-law; some have no one to help. Although known by different names in different parts of the country, the existence of traditional birth attendants all over the country has been confirmed by a recent study (Levitt, 1988). Since more than 80 percent of deliveries still take place at home, the training of traditional birth attendants becomes necessary for safe delivery, cutting of the umbilical cord, removing the placenta, etc. Among some people, cutting of the cord and removal of the placenta may be done by others than traditional birth attendants as these are considered polluting work. Attempts have been made by government and non-governmental agencies to train traditional birth attendants in Nepal since the early 1970s (ibid.). In some ethnic groups, traditional birth attendants are sought for prenatal care too. Hospital deliveries and doctor or nurse assisted deliveries are practised only by a few women.

Unscientific or unsanitary delivery may lead to early neonatal deaths. A survey done by WHO in 1982 shows that there were 15 neonatal tetanus deaths per 1000 live births, which accounted for 39 percent of all neonatal deaths (Foster, 1983). Health personnel assisted and hospital deliveries are important for infant survival, not only because early immunizations and immunization schedules are provided but also because health personnel can detect birth related illnesses of the newborn. The data collected by the "Vital Events for Child Survival" project in the years 1989-1991 in Jumla district of Nepal shows that "birth related"[7] infant deaths are higher than deaths from other causes. Medical assistance, or at least assistance of trained traditional birth attendants during delivery, is vital for the survival and well-being of infants and mothers.

Demographic Factors

Age of Mother

Infant mortality is known to be influenced by the age of mother. This is because, "Adolescents who become pregnant within two years of menarche have a higher incidence of perinatal complications since their bodies are still physiologically and anatomically immature" (NPC/UNICEF, 1992: 85). In addition, very young mothers may not be able to take care of their babies properly. The mean age of women at marriage in Nepal is 18.1 indicating that many marriages occur before this age (Appendix 3). Some of the consequences of child bearing at an early age are low birth weight babies, birth complications, maternal and neonatal morbidity and mortality. On the other hand, child bearing after the age of 40 is also considered dangerous. The inflexibility of muscles and bones and the possibility of mature age diseases like high blood pressure, diabetes, obesity, heart diseases, etc. may increase the risk of death of both the mother and the infant. As the fertility rate is very high in Nepal (Appendix 9) and women conceive well after the age of 40, newborns have a high risk of dying.

Parity

A total fertility rate of 5.6 shows that fertility in Nepal is high indeed (Appendix 9). The cumulative fertility (children ever born) as reported in this survey (Demographic Health Survey) shows that nearly six out of ten currently married women in the 45-49 age group have had at least six or more children (Nepal Fertility, Family Planning and Health Survey, 1991). Parity these days has declined remarkably from some decades ago when people deliberately chose to have larger families because of high infant and child mortality, so that some children could be expected to live as expected to reach adulthood.

Another reason for high fertility is the need to increase the labour supply required in agricultural work. In addition, birth spacing was introduced later and was not popular for several reasons. The most prominent reason was son preference in most of the ethnic families to preserve the lineage, to ensure the salvation of parents after death, and to have sons as caretakers in parent's old age. This led to larger families as they produced children until a son was born. Whatever the reasons, high parity certainly undermines women's health. Since the processes of pregnancy and delivery are very complicated, frequent repetition of this process makes women weak and unhealthy. As a consequence of this and lack of proper and sufficient care due to too many siblings at home, the infants suffer.

Life Style Factors

Breastfeeding

Breastfeeding is universal in Nepal. Over 90 percent of infants are breastfed up to five or six months (till the rice feeding ceremony), and the majority of mothers continue to breastfeed their children up to two years (NPC/UNICEF, 1992). Breastfeeding is known to protect infants from infectious diseases like diarrhea and acute respiratory infections. Breastfeeding could have been a life saver to infants in remote rural areas where insufficiency of health care facilities, education, sanitation, and good food, are prevalent. How breastfeeding protects infants from diseases can be understood from the following:

> The maternal immunoglobulins secreted into breast milk play a critical role in protecting the newborn from infectious diseases. This protection is especially important during the puerperium, since the

> infants' own immune system is immature and has yet to be exposed to the full range of pathogens present in its environment. Indeed, it is likely that a large portion of the protective effect of lactation against disease and death during the first few months of life is immunological rather than purely nutritional in nature. (Wood, 1994: 334)

The World Fertility Survey showed that Nepal had one hundred percent breastfeeding with a mean duration of 29 months and mean duration of amenorrhea of 21 months (Huffman, 1983). Tuladhar (1992) found an average duration of breastfeeding of 25 months for rural women and 22 months for urban women. His study showed a positive association between breastfeeding and women's age, and a negative association between breastfeeding and parity. The study also mentioned that Nepali women practised breastfeeding to space births at lower parity.

Birth Weight

Low birth weight is another factor which affects infant mortality. Low birth weight babies are more susceptible to illness, particularly acute respiratory infection. A hospital survey data that shows 24.6 percent low birth weight (Gautam, 1988) or an average birth weight of 2.77 kg. at the Maternal Hospital in Kathmandu cannot be taken as the average true birth weight of overall newborns because about 85 percent of births still take place at home, away from the hospital. A study done in Jumla (Pandey, 1991) shows that low birth weight is one of the major causes which leads to neonatal infant deaths. Low birth weight is also related to smoking. Women in the higher social classes in some ethnic groups (for example, Thakuris), and almost all rural women and women in the lowest social class smoke in Nepal.

In addition, drinking is traditionally accepted in most of the ethnic groups. Although, smoking and drinking are forbidden during pregnancy, most of the women cannot quit their habit. These facts may have a direct effect on infant mortality.

Place of Work

As infant care is the sole responsibility of the mother in Nepal, the mother's workplace becomes an important determining factor in the survival of an infant. The country being agriculture based and women being involved in traditional work, the women here may work at home or away from home. Apart from agriculture and animal husbandry, women working at home are involved in tailoring, handicrafts, preserved food, shops and restaurants (usually on the first floor of the house), self-owned cottage industries, etc. Infants whose mothers are engaged in above mentioned work, may be advantaged by having a greater chance to be with their mothers, especially if they are breastfed.

On the other hand, if the workplace is away from home, infants are left behind in the care of elderly grandparents, older sibling or house maids/baby-sitters who may not be able to provide "quality care". Moreover, the infants are disadvantaged by less frequent breastfeeding as well as too early weaning. As day care facilities in work places are rare in Nepal, this situation has become an issue as more and more women work outside of home. In addition, for women in agricultural work, if the working field is away from home, infants are sometimes taken to the field; but the unsanitary surroundings, constant use of manure, fertilizers, etc., may be harmful to the infants, especially after they start crawling or learning to mouth whatever is handy. Thus the workplace of mothers becomes an important determinant of infant mortality in Nepal.

Standard of Living

High infant mortality, high total fertility, low life expectancy, low literacy, and low gross domestic product, clearly show the general low standard of living of the people of Nepal. However,

> Despite gloomy statistics, Nepal has so far avoided the problems of starvation and chronic malnutrition, of disruptive urban migration and slums, and of burdensome foreign indebtedness and lack of convertible currency reserves (except for the troublesome Indian rupee) that plague other developing economies. (Rose, 1980: 97)

Due to the political situation and traditional background, Nepal is making slow progress in its development. People were unaware of the development activities occurring around the world due to isolation until 1950. The standard of living remained stagnant for several years. Furthermore, the lower social status of the people originating from the multiple hierarchical caste system led to a deterioration in the standard of living, resulting in a trend of the rich getting richer and the poor getting poorer. Consequently, the less privileged infants of the rural and urban poor people are affected adversely by those situations.

To make the situation worse, the rainy season creates food shortages and consequently higher prices for food. Fortunately, people from every ethnic group have a traditional practice of preserving dry and wet food. Extremely cold months in the mountains expose infants to acute respiratory infection and the extremely warm months in summer spread diarrhea and other intestinal diseases among the Terai infants. In addition, the rainy season spreads contagious diseases in the hills when contaminated water, sewage, etc. flow down the hills. The infants from poor families suffer the most in such situations due to insufficient food; not having warm clothes, fuel for heating the rooms, and well ventilated and clean houses. Thus a higher standard of living is very important to save the lives of infants.

The lack of clean drinking water, toilets, adequate drainage system, etc. make the situation worse, and infants who still have to develop immunity to survive in such situations are hit the hardest. Apart from this, infant feces are not considered to be dirty or contaminating by illiterate women who may neglect to wash their hands with soap after changing diapers. Moreover, although Nepal is known to be rich in water resources, scarcity of clean water is a persistent problem. In the hill and mountain areas, clean water has to be carried daily from several miles away even today. Hence, along with availability, the quantity of clean water which rural women can use daily may affect infant survival.

Infant mortality has remained a focus of study for social scientists for decades, especially concerning the developing countries where the reasons for high infant mortality are many and varied. While in the developed countries, infant mortality rate has already reached a lower level, the developing countries are trying to lower it and are studying the reasons for its slow decline. Mosley (1983) developed the "proximate determinants framework" under the following premises:

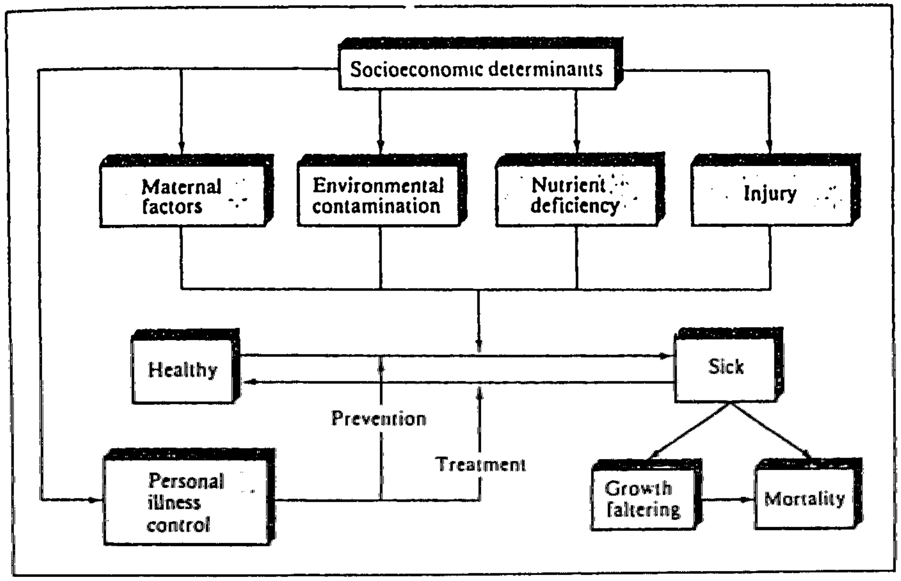
> (1) In an optimal setting, over 97 percent of newborn infants can be expected to survive through the first five years of life. (2) Reduction in this survival probability in any society is due to the operation of social, economic, biological, and environmental forces. (3) Socio-economic determinants (independent variables) must operate through more basic proximate determinants that in turn influence the risk of disease and the outcome of disease processes. (4) Specific diseases and nutrient deficiencies observed in a surviving population may be viewed as biological indicators of the operations of the proximate determinants. (5) Growth faltering and ultimately mortality in children (the dependent variable) are the cumulative consequences of multiple disease process (including their biosocial interactions). Only infrequently is a child's death the result of a single isolated disease episode.(Mosley, 1985: 27)

Through this model (see figure 3), he identified a set of proximate determinants, or intermediate variables, which directly influence the risk of morbidity and mortality. The model shows how all the social and economic determinants operate through these variables to affect child survival. He grouped the proximate determinants into five categories, namely,

> (i) maternal factors: age; parity; birth interval, (ii) environmental contamination: air; food/water/fingers; skin/soil/inanimate objects; insect vectors,(iii) nutrient deficiency: calories; protein; micronutrients (vitamins and minerals), (iv) injury: accidental; intentional, (v) personal illness control: personal preventive measures; medical treatment. (Mosley, 1985: 27)

The "proximate determinants framework" above shows clearly how socio-economic factors are mediated through health, demographic, and environmental factors to affect child survival. This framework is used in the analysis of determinants of infant mortality in this study. Chapter 3 examines some of the previous studies relating to infant mortality in Nepal and other countries.

Figure 3
Mosley's Framework


Socioeconomic determinants
Maternal factors
Environmental contamination
Nutrient deficiency
Injury
Healthy
Sick
Prevention
Treatment
Personal illness control
Growth faltering
Mortality

CHAPTER 3

STUDIES ON INFANT MORTALITY

General Studies

Infant mortality has decreased significantly in the developed and the developing countries over the last 50 years. The rate of decrease is much slower in the developing countries than in the developed ones. As mentioned earlier, the majority of infant deaths is due to endogenous causes in the developed countries whereas in the developing countries, the exogenous causes of death still predominate. In 1930, the average infant mortality rate of the developed countries was 130 per 1000 live births, which declined to less than 14 per 1000 live births by 1980 (Klinger, 1985). Sweden has remained an example by having the lowest infant mortality rate (6.9 per 1000 live births) for the last two decades. Recently Japan seems to have taken over the title with an estimated rate of infant mortality of 4.3 per 1000 live births (from that of Sweden at 4.8 in 1995) (World Population Data Sheet, 1995).

Currently, Canada has one of the lowest estimated infant mortality rates of seven per 1000 live births. In Canada, the neonatal death rate declined from 30.7 per 1000 live births in 1941 to 4.1 in 1991, and the post-neonatal death rate dropped from 30.2 per 1000 live births in 1941 to 2.3 in 1991 (McVey and Kalbach, 1995). As seen from the data, "The more rapid improvement in post-neonatal mortality reflects the greater success that has been achieved against postnatal causes and conditions affecting the health of infants, such as infections and respiratory diseases, nutritional problems, and accidents" (McVey and Kalbach, 1995: 197). The following are some of the international studies reviewed in detail.

Newland (1981) compared infant mortality in countries with high and low rates. In her opinion, in countries with very low infant mortality rates, most of the infant deaths occur in the neonatal period as a result of low birth weight or congenital abnormalities; but in countries where infant mortality is high, environmental factors are paramount. She believed that the difference between a society of sufficiency and a society of deprivation is expressed much more eloquently by infant mortality.

A speculation of Newland's regarding the much discussed human development indicator, gross national product (GNP) *vis-a-vis* infant mortality is that, "As a social indicator, the infant mortality rate illuminates much that a measurement of the GNP obscures." To show the inconsistency of the direct relationship between per capita income and infant mortality, she gave some examples of different countries. First she gave an example of Libya and Qatar, with GNPs of $7,210 and $15,050 and IMRs of 130 and 138 per thousand live births respectively, and talked about Japan which has a GNP of $7,700 and an infant mortality rate of eight. Comparing Japan with other high GNP countries like Libya and Qatar, she argued that the GNP has nothing to do with infant mortality and is only a measure of the goods and services produced in a country.

As a supplement to this assertion, she discussed the correlation between poverty and high infant mortality, and between wealth and low infant mortality which she found to be far from perfect. She expressed her view as, "Poverty itself does not cause babies to die, nor does wealth rescue them." Her second important example was Sri Lanka and Niger which have GNPs of $200 and $240 with IMRs of 42 and 200 per thousand live births respectively. Although both these countries have low and nearly the same GNP, Sri Lanka has only 42 infant deaths per thousand live births while Niger has 200. She summarized her view as, "Because infant mortality is so closely tied to broad economic and social conditions and to the complex interactions between them, specific interventions designed to improve a baby's chances of survival may have a limited effect if they are pursued in isolation."

In 1977, Antonovsky and Bernstein examined the relationship between the components of infant mortality (namely perinatal, neonatal, and post-neonatal) and social class by analyzing the data on infant mortality from Western Europe and the United States. In spite of improvements in public health, housing conditions, medicine and surgery, and living standards, the authors found that even though infant mortality had declined dramatically in the past century, the inverse relationship between social class and the components of mortality had not narrowed. They also observed that the first-week mortality was the dominant contributor to neonatal mortality with a much smaller class gap than that for late neonatal mortality. The authors discussed the "capital assets" thesis and "time-lag" argument of Morris and Heady (1955), and the "social mobility" argument of R. Illsley (1955) and showed empirical evidence for the first and the third arguments. The "capital assets" thesis suggests that the level of assets of a woman, education being one of them, is related to her success in child birth. The authors showed that in 1959, the mortality ratio was

100:350 for Hungarian mothers with more than 13 years of education versus those with no formal education. The "time-lag" thesis, argues that the benefits of medical knowledge and facilities are likely to be felt first by the upper classes and only after some time lag by the lower classes. The authors further discussed this theory in terms of Powledge's (1976) findings. The "social mobility" argument posits that women with good childhood health, education and other assets tend to be upwardly mobile, while those lacking such assets do not (Illsley, 1955). The example from Rhode Island supported this hypothesis: the perinatal mortality rate for women born and marrying in Class III was 34; the rate was 17 for women born in Class III and marrying into Class I-II; while for the downward mobility, that is for Class III women marrying into Class IV-V the rate was 56. The social classes for the study were ranked "Class I" as those with highest social status, and the class ranks go higher as the social status goes lower.

Further the authors observed that although "Low social class *per se* does not cause high infant mortality," a number of directly causative biological and behavioral variables such as low weight gain during pregnancy, prenatal care visits (doctor or hospital visits), etc. varied according to different social class, consequently resulting in high or low infant mortality. In the low weight-gain (known to be the consequence of poor nutrition) category, 16 percent of pregnant women in Class IV and four percent in Class I were observed from Miller's (1976) study. In the same study, 57 percent of Class IV pregnant women and 16 percent in Class I were found to be "smokers" which is known to contribute to low weight gain.

From Dott's (1975) study in Louisiana, the authors reported an infant mortality rate of 10.6 for women making more than nine prenatal visits versus 83.4 for those without any. In addition, they believed that very young, very old, unmarried, and high parity women have the highest infant mortality risks. The study revealed that most of these women came from the lower socio-economic categories. The conclusion that emerges is that infant mortality is closely linked to social class.

In a study on less developed countries, Jayachandran and Jarvis (1983) found that the level of socio-economic development plays a significant role in bringing down the level of infant mortality rate. Based on their findings, they suggested that the health care delivery system should shift from a hospital-based, disease treatment oriented ("basic health care") to "primary health care" which emphasizes prevention through improvements in education, nutrition, water supply and sanitation.

In a comparative analysis of infant and child mortality in Sri Lanka and Bangladesh, Jayachandran et al. (1985) found the length of breastfeeding, duration of marriage, the standard of living and mother's education to be especially important determinants of infant and child mortality.

Studies on Nepal

In the case of Nepal, a few national level studies on infant mortality have been done. In one of these studies, Gubhaju et al. (1987) estimated infant mortality trends and differentials by using data from the 1981 Nepal Contraceptive Prevalence Survey (NCPS), the 1976 Nepal Fertility Survey (NFS) and the 1981 Census of Nepal.

The comparative analysis indicated that infant mortality rate derived from the NFS maternity histories was the most accurate. Their findings revealed that infant mortality was lowest in the hill region, higher in the Terai and highest in the mountain region. They found lower infant mortality among the literate and a higher rate among illiterate mothers. Father's literacy showed little difference in infant mortality. Another interesting finding was that male babies had slightly higher infant mortality than female babies. Their analysis further suggested that infant mortality declined with birth order, but death of the previous sibling before the birth of a baby raised infant mortality risks for that baby.

In another study, Shrestha, Gubhaju, and Roncoli (1987) examined geographical variations in infant mortality in Nepal, and their relationship to selected variables, standards of living and levels of socio-economic development using district level data. They found higher infant mortality in the mountains (IMR=186) among the three geographic regions and in the Mid-western region (IMR=178) among the five development regions. In general, the infant mortality rate increased as one moved from eastern to western Nepal, with the exception of the Mid-western region which had the highest infant mortality rate. In the same manner, an increase in infant mortality was observed as one moved from south to north. These results suggest that infant mortality is inversely associated with the level of socio-economic development as the eastern and southern areas of Nepal are better off socio-economically than the western and northern areas. As a result of uneven distribution of infrastructure, health and other services, the district infant mortality rates do not show any pattern. Among the infant mortality rates, the highest was in the Dailekh district (IMR=294) and the lowest in the Palpa district (IMR=52), both of which are in the hill region. The lowest infant mortality rate in Palpa (of all the districts in the country) is not surprising as Palpa had a missionary hospital with excellent maternity service since 1954.

With the regression analysis, the authors found that controlling for all other factors, production of cereals per capita and literacy (both male and female) were negatively associated with infant mortality, while the population to health worker ratio, female labour force participation, and the proportion of female labour force participation in non-agricultural activities were associated with increased infant mortality.

The proportion of female labour force participation had a strong positive association with infant mortality. The authors explained this fact as, "Women who work outside the home must leave children in the care of other people, which may result in "lower quality" childcare. Mothers working outside the home may also be unable to breastfeed their children, which also may affect the survival and well-being of the infant." Contrary to this explanation, the correlation showed a negative association between infant mortality and female labour force participation in non-agricultural sectors. They noted that "The negative association could be attributed to the fact that most Nepalese women working outside of the agricultural sector are more likely to be educated and living in urban areas both of which are negatively correlated with infant mortality rates."

Female literacy emerged as the most closely associated factor to infant survival. Moreover, the influence of female literacy on infant mortality was found to be more significant than that of male literacy.

Another study by B.B. Gubhaju (1991) which was based on the Nepal Fertility Survey 1976 with a sample size of 5000, involved both infant and child mortality. By computing "probability of dying" for infants in different regions and with different socio-economic status, Gubhaju found that the mountain region had the highest infant mortality followed by Terai and hills. For the three socio-economic variables used, his finding showed that father's education had a reducing impact on infant mortality. Surprisingly, mother's education hardly affected infant mortality. However, he admitted that while interpreting this finding from rural areas, "the small number of births in the educational category of mothers and the fact that most of them had less than completed primary education" should be considered as well. He did not find any difference between infant mortalities experienced by working and non-working mothers, except for the Terai region where infant mortality was substantially higher for working mothers.

Another part of this study involved demographic factors, sex of the child, birth order, maternal age, survival of previous child, and length of preceding birth interval. Gubhaju did not find any indication of sex discrimination which might have resulted in a higher risk for female infants.

Although the first order births were found to be at a relatively higher risk of dying during infancy, after controlling for maternal age, the first order births did not show a higher risk of dying. Thus the risk of dying of first order births was attributed to the higher proportion of very young mothers. The results also indicated that "the high order births are at a higher risk of dying during infancy."

Yet another finding of the study was that women under age 20 had the highest risk of infant deaths, which declined with the increase in maternal age till 30-34 and increased negligibly after 35 years. Using a logit-linear model, the author showed that the reason for greater risk of infant death to younger mothers was the short birth interval. First, when maternal age alone was considered, mothers aged less than 20 years had about 34 percent greater risk of infant death than those in the age group 20-29. When other variables including birth interval were controlled, the net effect of maternal age on infant mortality turned out to be statistically insignificant.

Next, the study showed the combined effect of maternal age and parity as "Fifth order births to women aged 20-24 and third order births to women under 20, had a risk (of) about one death in every four live births." One interesting finding of the study was that irrespective of the length of the preceding birth interval, the probability of the reference child dying during infancy was considerably higher among the children of mothers whose previous child had died than if the previous child were alive.

CHAPTER 4

DATA AND METHODOLOGY

Objectives

The objectives of this study are:

1. To analyze the effects of different demographic factors on infant mortality.
2. To study the impact of socio-economic variables such as ethnicity, religion, education of mother, education of father, occupation of father, etc. on infant mortality.
3. To study the rural/urban differential in infant mortality.
4. To evaluate the risk of life style factors on infant mortality.

Hypotheses

The following research hypotheses have been formulated based on a review of the relevant literature.

A. As breastfeeding is believed to protect infants from dangerous childhood diseases such as acute respiratory infection, diarrhea, etc. the first hypothesis for this study would be: the longer the duration of breastfeeding, the less likely the chance of infant deaths.

B. Socio-economic status like education, occupation, and income, has a direct or indirect effect on infant mortality. The second hypothesis would be: as socio-economic status of a population improves, infant mortality decreases.

C. Age of mother is associated in many ways with infant mortality. Biological factors such as physiological immaturity of mothers may result in birth injuries and low birth weight in babies, which are directly related to high infant mortality. With this view, another hypothesis would be: infant mortality will be higher for very young mothers.

D. Urban areas have more and better medical facilities than rural areas and urban women have more access to education, jobs,etc. In addition, their standard of living is higher than that of rural women. Since all of these factors affect the infant mortality, another hypothesis would be: urban areas will have lower infant mortality than rural areas.

E. High parity may mean less infant care, more economic burden and low birth interval. This also affects mother's health inversely; consequently unborn babies and newborns would be disadvantaged. Thus another hypothesis would be: as parity increases, infant mortality increases.

F. Pregnant mothers' health care has a direct effect on the unborn baby. Thus medical advice and nutritious food are essential for delivering a healthy baby. Attendance of a doctor, nurse or trained midwife is necessary for a safe delivery. Similarly, seeking a doctor's advice, timely vaccinations, sanitation, etc. are other factors necessary to save infants from the risk of dying. Hence the hypothesis: for those women who visit a doctor or a clinic in their pregnancy, and for those who obtain medical assistance during delivery and who immunize their infants, infant mortality would be lower.

Data and Survey Design

The data used for this study are from Nepal Fertility, Family Planning, and Health Survey 1991 for which the Demographic Health Survey (DHS), Model "B" questionnaire with some modifications was administered. The data are provided by Macro International Inc., Columbia, Maryland, USA, with the permission of the Health Ministry, His Majesty's Government of Nepal. The data are based on household and individual surveys, with 24,745 and 25,384 interviews respectively. Out of 24,745 sampled household cases, 1,238 (five percent) are urban and 23,507 (95%) rural while 1,353 (5.3%) cases are urban and 24,031 (94.7%) rural out of 25,384 individual ones. The individual sample unit is the woman in the age group 15-49 who is living with her husband and who slept in a sample household the night before the interviewer's visit. In the survey sample, main emphasis was given to the equal allocation of sample units among districts, irrespective of differences in district size. The acceptable minimum sample size was considered to be about 400 women per district (for family planning variables) and about 2000 women per sub-region (for mortality variables) (Ministry of Health, 1993).

In general, two wards were selected from each "Village Development Committee." Urban wards were selected directly as the primary sampling units. Three stages of selection were involved for rural and only two for urban samples. The sample was designed in such a way that within each district, urban and rural samples had the same overall design probabilities (and hence the same design weights). The target sample at the national level was 24,816 households and 31,020 women on the assumption of 1.25 women per household. The sample frame was the voter's list of 1990 prepared by the National Election Commission.

The survey was conducted in two phases, the first on August 11, 1991 and the second on November 24, 1991. Seventy-five field teams (one each for 75 districts) with each team consisting of one supervisor and three female interviewers completed the field work in February, 1992.

Design of Data Extraction for the Current Research

The variables used for the study were drawn from the individual data of the survey, except for living condition variables which were selected from the household survey data. The samples for this study were drawn from fifty percent of the urban and five percent of the rural cases out of the survey data. The sample size selected for this study turned out to be 1859.

Statistical Model

For analysis purposes, infant mortality rate is the dependent variable. The independent variables selected are: residence, ethnicity, religion, education of mother, education of father, occupation of mother, occupation of father, age at first marriage, breastfeeding duration, prenatal care, postnatal care, standard of living, place of delivery, parity, delivery assistance, and place of work. First, correlation coefficients are computed to study the relationship between the independent variables, and also to trace any multicollinearity that may exist between the variables.

In the second phase, the effect of each independent variable on infant mortality rate, controlling for other variables, is studied by logistic regression analysis.

Since the dependent variable is dichotomous (probability of dying versus probability of not dying), logistic regression is selected to analyze the data. This model is better than multiple regression because the predicted values in multiple regression may be in the range minus infinity to plus infinity. Since the values do not fall in the interval between 0 and 1, they cannot be predicted as probabilities. Moreover, when the dependent variable can have only two values, it is unreasonable to assume that the distribution of errors is normal (Norusis, 1994). The following model is used for this study.

$$\log [p/(1-p)] = a+b_1X_1+b_2X_2+\dots\dots\dots.+b_{16}X_{16}$$

The dependent variable is represented by $\log [p/(1-p)]$,

where p is the probability of deaths of infants in the first year,

a the intercept term,

$X_1, X_2, \dots\dots\dots, X_{16}$ are the independent variables,

the coefficients $b_1, b_2, \dots\dots\dots, b_{16}$ are the changes in log odds associated with a one-unit change in the independent variables respectively.

That is,

$$\log [\text{probability (dying)}/\text{probability (not dying)}] = a+b_1X_1+b_2X_2\dots\dots\dots+b_{16}X_{16}$$

The appropriate signs (directions) of slopes emerge from the hypotheses. The direction of slopes has the following meaning. If b_1 is negative, X_1 has a negative effect on infant mortality and if b_1 is positive then the effect of X_1 positive. The SPSS package is used to generate the estimates. Appropriate diagnostics are used to check for problems in the regression analysis.

Measurement of Variables

For logistic regression, residence is measured as a dummy variable with urban as 1 and rural as reference or zero. Three dummy variables are created for ethnicity representing four categories namely Brahmin and Chhetri, Newar, Mongoloid group (Gurung, Magar, Rai, Tamang, and Sherpa), and "all others" with reference category as Brahmins and Chhetris. Similarly, for religion three dummy variables are created for Buddhists, Muslims, and others with the reference category as Hindus. Education of mother and father are measured by the highest grade completed by the mother and the father respectively. Occupation of mother and father are both measured as four categorical variables, creating dummy variables for cottage industry and business, service, and all others, and agriculture as the reference category.

Age at first marriage is measured in actual years. Duration of breastfeeding is measured in months a baby was breastfed. Prenatal care is measured by combining two variables: (a) visit to a doctor, (b) visit to a nurse/midwife. This variable takes three values 0, 1, and 2 where value of 0 means "no visit", value of 1 means "visit to either a doctor or nurse/midwife", and value of 2 means "visit to both doctor and nurse/midwife." The category with value 0 or "no visit" is the reference for this variable. In the same manner, postnatal care is measured by combining three variables: (a) received BCG vaccination, (b) received polio drops, and (c) received measles vaccination. Thus in this case, the variable takes values 0, 1, 2, and 3, where 0 means receiving "no vaccinations", 1 means "receiving one of the three immunizations", 2 means "receiving two of the three immunizations", and 3 means "receiving all three immunizations", the reference category being 0 or "receiving no immunizations."

A dummy variable is created to measure the place of delivery, where 1 represents the deliveries occurring at hospitals, health centres, health posts and clinics, and zero represents the reference category, denoting deliveries occurring elsewhere (mostly at home). Delivery assistance is measured by combining two variables: (a) assistance given by doctor, and (b) assistance given by nurse/midwife. This variable takes the values of 0, 1, and 2 where value of 0 means "no assistance of medical personnel", value of 1 means "assistance of either doctor or nurse/midwife", and value of 2 means "assistance of both doctor as well as nurse/midwife." The reference category for this variable is 0, that is "no assistance of medical personnel." Parity is measured by the actual number of births to the respondent. Place of work is another dummy variable representing 1 when mother works at home and 0 when she works away from home. Another dummy variable is created to measure the standard of living, where 1 represents the use of piped water, handpump and flush toilet in the household.

The measurement of categorical variables with more than two categories is shown in Table 5 below.

TABLE 5
MEASUREMENT OF CATEGORICAL VARIABLES

Variable	Categories	Value
Ethnicity	Brahmin & Chhetri	0
	Newar	1
	Mongoloid group	2
	others	3
Religion	Hindu	0
	Buddhist	1
	Muslim	2
	others	3
Occupation of mother	Agriculture	0
	business & cottage industry	1
	service	2
	others	3
Prenatal care	No visits to medical personnel	0
	visit to doctor or nurse/midwife	1
	visit to both doctor and nurse/midwife	2
Postnatal care	Received	
	no immunizations	0
	one of the three immunizations	1
	two of the three immunizations	2
	all three immunizations	3
Delivery assistance	No assistance of medical personnel	0
	assistance of doctor or nurse/midwife	1
	assistance of doctor & nurse/midwife	2

Note: The value 0 represents the reference group.

CHAPTER 5

FINDINGS

The infant mortality rate was found to be 114 per 1000 live-births from the data used in the study, so the difference from the census value is not very big. When the zero-order correlations of all the relevant independent variables were studied, except for "delivery assistance" and "place of delivery" variables, none of the variables showed multicollinearity among themselves (Appendix 10). This problem of multicollinearity is automatically solved as the two collinear variables are not entered in the same equation.

As mentioned earlier, all fifteen independent variables could not be entered in one logistic regression model since five of the variables had too many missing cases. Before determining the effect of each relevant independent variable controlling for other variables, individual logistic regression was fitted for each of the fifteen variables (Table 6).

In table 6, the constants give the log odds of infant deaths corresponding to the value of zero (or to the reference category in case of categorical variable) for the independent variable. For example, the log odds of infant deaths when education of mother takes the value zero (that is, no education) is -1.7028. From this the infant mortality rate when mother's education is zero can be seen to be .154 calculated as follows:

$p/(1-p) = e^{-1.7028} = .1821$

$p = \text{odds}/(1+\text{odds}) = .1821/(1+.1821) = .154$

Thus, log odds of infant deaths when mother has 5 years of education is $-1.7028+5(-1.531) = -2.4683$

From this, we can calculate the infant mortality rate for this group, which is .07811,calculated in the following way. For one year increase in education, the odds are reduced by a multiplicative factor .8581.

$e^{-2.4683} = .084729 = p/(1-p) = \text{odds}$

$p = \text{odds}/(1+\text{odds}) = .0847/(1+.0847) = .07811$

The results show that as education level of mother goes up, the odds (the relative ratio of the probability of infant death to survival) are reduced by a multiplicative factor of .8581 or for each year of education, the odds are reduced by 15%. Although increase in father's education [8] also shows reduction in odds by a multiplicative factor of .9963,this result is not significant. When the infant's mother works at home the odds of dying are reduced by a multiplicative factor of .6136 (40% reduction). As parity goes higher, for one more birth the odds increase by a multiplicative factor of 1.2261 (23% increase). For those who use clean water and flush toilets, the odds lower by a multiplicative factor of .7432 (25% reduction); however the decrease is not significant.

Looking at the categorical variables, in reference to agricultural occupations, the odds for women in business and cottage industry would be reduced by a multiplicative factor of .6763 (33% reduction); the odds for women in service[9] would be reduced by a multiplicative factor of .4202 (58% reduction); and even for women in other occupations, the odds would be reduced by a multiplicative factor of .6682 (34% reduction). But for fathers, the odds would be reduced significantly by a multiplicative factor of .6555 (35% reduction) only for those who are in service, compared to those in agricultural occupations. Although seeing a doctor or nurse/midwife during pregnancy reduces odds, these are insignificant. Delivery assistance by medical personnel shows decreased odds; however only assistance by both doctor and nurse/midwife shows significant decrease by a multiplicative factor of .4723 (53% reduction). In postnatal care, compared to no vaccination, for those babies who had one of the BCG, polio, measles vaccinations, the odds are reduced by a multiplicative factor of .6780 (33% reduction); odds are reduced by a multiplicative factor of .6622 (34% reduction) for those who had two of the vaccinations and by .7566 (25% reduction) for those who had all three kinds of vaccinations. However, the first outcome of postnatal care (that is .6780) is not significant.

The ethnicity result shows that compared to Brahmins and Chhetris, odds for Newars decrease by a multiplicative factor of .4560 or by 55%. Although the odds for Mongoloid group are also lower compared to the reference group, the result is insignificant. In contrast, "all others" would have a significant increase by a multiplicative factor of 1.3290 (32% increase) in odds compared to Brahmins and Chhetris. As for religion, only Buddhists have a significant reduction in odds (by

30%) compared to Hindus.

Table 7 shows the logistic regression result of independent variables on infant mortality rate controlling for other variables. Odds increasing (by a multiplicative factor of 1.2123 or 21% increase) as parity goes higher (for one additional child born) is still highly significant. Odds significantly decrease by a multiplicative factor of .7423 (26% reduction) for urban women compared to rural even after controlling for other variables. Although showing decreased odds for higher age at marriage, the result was not significant. Standard of living, delivery assistance, religion, and occupation of husband were not significant.

After controlling for all other variables in the equation, seeking antenatal care, that is, compared to no medical care, seeing a doctor or nurse/midwife significantly increases odds by a multiplicative factors of 1.3817 and 1.7654 respectively. This was not expected. Compared to no vaccination injected, those infants who had two or more vaccinations shows decreased odds. However, injecting only one vaccination was not significant in reducing the odds.

Among the ethnic groups, Newars show a significant reduction in odds in comparison to Brahmins and Chhetris even when effects of all other variables are controlled. The Mongoloid group shows an opposite result once other variables are controlled, that is, increased odds compared to Brahmins and Chhetris. However, the odds are not significant in this case too. Compared to the reference group, all other ethnic groups together demonstrate a significant increase in odds by a multiplicative factor of 1.3156 (31% increase) even when other variables are controlled.

TABLE 6
LOGISTIC REGRESSION ON INFANT MORTALITY RATE FOR INDIVIDUAL EFFECTS OF DIFFERENT INDEPENDENT VARIABLES WITHOUT CONTROLLING FOR OTHER VARIABLES

Independent Variables	Constant	b	exp (b)	Significance
Education of mother	-1.7028	-.1531	.8581	.0001
Place of work (home)	-1.9155	-.4884	.6136	.0128
Occ of mother (ref.agri.)	-1.8840			
business+cottage ind.		-.3911	.6763	.0294
service		-.8670	.4202	.0408
all others		-.4032	.6682	.0000
Occ of father (ref.agri)	-1.9653			
service		-.4224	.6555	.0004
Age at marriage	-1.1966	-.0584	.9433	.0000
Parity	-3.1724	.2039	1.2261	.0000
Place of delivery(med.cen)	-2.0228	-.5841	.5576	.0057
Delivery assist(med.assist)	-2.0186			
both		-.7501	.4723	.0018
Postnatal care(ref.no vacc)	-1.9664			
two of the vaccinations		-.4122	.6622	.0129
all three vaccinations		-.2790	.7566	.0118
Ethnicity (ref.Brah+Chhe)	-2.0966			
Newar		-.7853	.4560	.0000
others		.2845	1.3290	.0015
Religion (ref. Hindu)	-2.0267			
Buddhist		-.3520	.7033	.0247

TABLE 7
LOGISTIC REGRESSION ON INFANT MORTALITY RATE CONTROLLING FOR OTHER VARIABLES

Independent Variables	b	exp(b)	Significance
Parity	.1925	1.2123	.0000
Residence (ref. urban)	-.2980	.7423	.0059
Prenatal care(ref.no medicare)			
doctor or nurse/midwife	.3233	1.3817	.0469
both doctor & nurse/midwife	.5684	1.7654	.0295
Postnatal care (ref. no vacc)			
two of the vaccinations	-.4785	.6197	.0047
all three vaccinations	-.3138	.7306	.0079
Ethnicity (ref. Brah+Chhe)			
Newar	-.4663	.6273	.0145
others	.2743	1.3156	.0051
Constant	-2.8611		

Hypotheses Testing

The first hypothesis had to be dropped in view of missing values on breastfeeding. The second hypothesis, "as socio-economic status of a population improves, infant mortality rate decreases" is supported by the logistic regression results of "education of mother", "occupation of mother", "occupation of father (for father in service)" (Table 6). From the same table, it was found that as "age at first marriage" goes up, the odds of dying are decreased. As those who marry early tend to conceive at younger ages than those who marry late, the third hypothesis "infant mortality would be higher for young mothers" is supported. From both the logistic regression tables, support for the fourth hypothesis "urban areas will experience a lower infant mortality rate than rural areas" is very strong. The fifth hypothesis, that infant mortality rate increases as parity increases, is supported quite strongly.

There is some support for the sixth and the last hypothesis. The hypothesis "for those who visit a doctor or a clinic in their pregnancy, the infant mortality would be less," could not gain any support. The support for other parts of the hypothesis "those who get assistance of medical personnel during delivery and have infants immunized would have fewer infant deaths" may be seen as partial.

CHAPTER 6

DISCUSSION AND CONCLUSION

Discussion

Among those variables which affect infant mortality significantly are parity, residence, age at first marriage, and education of mother. In other words, having more children in the family affects infant mortality in an adverse way. Living in an urban area helps to decrease infant mortality compared to living in a rural area. These two findings are supported strongly by the regression analysis controlling for all other variables. Except for father's education, availability of clean water and flush in bathroom, and prenatal care or seeing medical personnel, all other independent variables selected have a significant effect on infant mortality in the expected direction.

The most important research finding, that infant mortality is reduced as age at marriage increases, disappears once other factors are controlled. Age of mother is correlated with age at marriage, since those who marry early tend to give birth at a younger age than those who marry late. This finding suggests that age of mother alone does not affect infant mortality. Mother's education has a strong negative influence on infant mortality. Unfortunately, due to many missing cases, this could not be tested in terms of mother's education alone.

One strongly supported finding is that the higher the income the lower the infant mortality. Occupation of father shows that high income group families experience less infant mortality than do low income groups (those in service versus those in agriculture). However, this result disappears when other variables are controlled suggesting that income alone may not have a significant role in the survival of infants. From mother's occupation point of view, "other occupations" rather than "agriculture" reduces infant mortality.

If the delivery takes place at a medical centre or is assisted by both doctor and nurse/midwife, infant mortality is significantly decreased. Similarly, the babies, who have two or more than two immunizations, have greater chances of surviving. Those babies whose mothers work at home have a greater chance of survival than those whose mothers work away from home.

Among the different ethnic groups, Newar babies have a greater chance of survival compared to Brahmin and Chhetri babies. Ethnicity is not a strong factor in the case of Mongoloid infants. Compared to the reference group (Brahmins and Chhetris), infants in other ethnic groups have higher infant mortality. These results still hold true when all other factors in the main equation are controlled.

Analysis of religious differentials reveals that, Buddhist babies have a greater survival probability than do Hindu babies. However, this effect disappears when other effects are controlled suggesting that religion is mediated by other social factors.

Prenatal care is not a significant factor, although its relationship is in the expected direction. Surprisingly, when all other variables are controlled, seeking a doctor's and/or nurse's/midwife's care shows a significant positive effect on infant mortality rate. Although surprising, this finding can be explained. As discussed elsewhere, seeking prenatal care is not a traditional practice in Nepal. Therefore, only those who have pregnancy complications might have sought medical care, especially in rural settings. Obviously, pregnancy complications may have led to a higher incidence of infant deaths. Another explanation may be that number of prenatal visits is not included in the data analysis, which is very important to obtain significant results of prenatal care. Moreover, from this data it is not clear at what stage of pregnancy the women sought medical care. This is also quite important as different stages of pregnancy have different levels of risk.

Limitations

The data which are used in this study have some limitations, among which the number of missing cases affects the analysis the most. Out of sixteen variables selected, six variables, namely "education of mother," "education of father," "place of delivery," "breastfeeding," "occupation of mother," and "place of work," have more than 35 percent missing cases. For the reliability of analysis and results, these variables are each analyzed separately by logistic regression instead of being included in the main equation. Thus the effect of each of these variables while controlling for the effect of other variables could not be studied.

Unfortunately, among these six variables, breastfeeding had nearly 90 percent missing cases (1662 out of 1859 interviewed cases). Since the frequency distribution suggested possible unreliable results, this variable was dropped from the analysis. Another limitation is the income variable which was not included in the survey. For this reason, occupation of father is considered a proxy variable for "family income." The other limitations are that information on diet, nutritional status, and birth weight are not collected in the survey; hence birth weight and nutritional status variables have to be dropped from the analysis. Due to limitation of the coverage, "age of mother" is related to the "age at first marriage" variable and interpreted accordingly. Some of the questions included in the survey are not as desired or required by the study. One such example is the closed question, "Do you earn cash for this work?", for mother's income. An open-ended question like, "How much do you earn from this work?", would have been more relevant to measure the income of the mother.

There are some other limitations in the data used. One of the limitations is that the data on infant deaths do not refer to one particular year. It combines the infant deaths which occurred in a number of years prior to the survey. Another limitation is that those infants (less than one year of age) who were alive at the time of the survey are counted as survivors till their first birthday. This may not be true, as some of them may have died before they were one year old.

Conclusion

Infant mortality rate has been considered a sensitive and human development indicator of a nation. The infant mortality rate in Nepal, currently at 97.5 per 1000, is indeed high. Although public health personnel and demographers disagree about the contribution of socio-economic development and public health programmes in reducing mortality (including infant mortality), in an underprivileged, landlocked, extremely traditional and culturally diverse country such as Nepal, infant mortality is found to be determined by both socio-economic and health related factors. It is difficult to priorize the determinants (socio-economic *vis-a-vis* health). The view of Krishnan (1975), that "Generalizations in demography regarding mortality decline need revision in the light of the experiences of countries such as India and Sri Lanka," may hold true in the case of Nepal as well. The slow decline of infant mortality in Nepal is indubitably linked with many factors that influence it adversely.

The findings from this research show that residence, parity, ethnicity, and immunization are the main factors which determine infant mortality in Nepal. The logistic regression results (Table 7) show that those who are living in urban areas, who are from Newar families, who have fewer children, and whose infants are immunized (with two or more than two of BCG, polio, measles immunizations), would experience lower probability of infant deaths. Other factors which affect infant mortality are education, occupation, age at marriage (consequently age at motherhood), place of work of mother followed by place of delivery, delivery assistance. Father's occupation, and religion influence infant mortality to a lesser extent.

Residence turned out to be an important factor which influences infant mortality strongly. It is not surprising that urban infants have a much greater chance of living than do rural infants because of the disparities between the status of urban and rural people. Most of the rural people rely on subsistence agriculture. They have only limited health information. Their limited mobility and traditional life style may have an additional negative effect on infant mortality. Although, urbanization is taking place steadily in Nepal, more endeavour is needed to overcome the difficult topography of the country. Changes in the strategies of development are essential. The following speaks volumes for this aspect of the issue.

> The Seventh Five Year Plan (1985-90) included for the first time, an urbanization and housing policy component and made an attempt to incorporate urban development objectives and strategies in the national development context. However, it should be noted that the urban national policy and the strategies for urban development do not have a focus on urban poor nor on urban children and women. (NPC/UNICEF, 1992: 171)

Another influential factor is found to be "parity." The total fertility rate in Nepal has remained unchanged for some decades (Appendix 9). Although other demographic figures have changed over time and the trend is in the expected direction, the total fertility rate has remained stagnant. Generally, women rely on a traditional practice, breastfeeding, to limit the family size. Modern methods of birth limitation are gaining popularity rather slowly. Whatever the reason (for example, culture, religion, son preference, fear of high infant and child mortality), high parity affects infant mortality inversely.

These findings demonstrate that immunization is an important determinant of infant mortality. Immunization is slowly but steadily gaining ground in the country. In view of its important role in reducing infant mortality, immunization should be given a high priority in government programmes.

Another factor that influences infant mortality is ethnicity. Newar infants have lower infant mortality, as compared to Brahmin and Chhetri infants, whereas the "others" ethnic infants have a higher probability of dying than does the reference group. This may be due to life style, eating habits, place of residence, practice of prenatal and postnatal care, and better socio-economic status of the Newars. It is important to keep in mind that Muslims and the untouchables from Terai and the hills have very low socio-economic status.

In general, the people of Nepal live harmoniously co-operating with one another at times of distress or in different ceremonies, whether in rural or urban areas. But there is a distinct ritual called *"guthi"*[10] among the Newars which organizes different community programmes, provides service within the group and co-operates with the community people at times of misery, famine, and ceremonies. Although *"guthis"* are abandoned by some communities, the active traditional *"guthis"* perform several activities (one being funeral services) and help the needy people. This kind of organized life style, not usually found among other ethnic groups, may have a positive impact on the health and well-being of the families within the community, with a positive influence on the well-being of infants. Although every ethnic group has its own beliefs and cultural practices, and may not want to assimilate with the valley people, some improvements may be brought about in their life style to lower infant mortality. A detailed study of ethnicity and infant mortality may help to understand the dynamics of the relationship of the former with the latter.

Father's education, and availability of clean water and flush toilets do not have a significant effect on infant mortality. Seeking the care of a doctor or nurse/midwife or both during pregnancy resulted in higher infant mortality supporting the notion that women seek medical care mostly for pregnancy complications, the consequences of which may lead to higher infant mortality.

Apart from these factors, there are several intervening variables such as lack of infrastructure, proper shelter, etc., which affect the health and well-being of infants. For example, lack of motorable roads prevents people from going to hospitals, or lack of schools near the villages keeps them ignorant and lack of hospitals near the villages makes them reluctant to visit them. A study of the relationship between these variables and infant deaths is warranted. High infant mortality remains a challenge to the development of the country.

Policy Implications

In the present context, there seem to be four major factors which affect infant mortality in Nepal. They are: residence, parity, immunization, and ethnicity. For a geographically, politically, and economically deprived country like Nepal, planning is not an easy task. To begin with, the policy and programme planners should consider the fact that progress in reducing infant mortality comes from "prevention" rather than cure. Priority should be allocated to the decentralization policy rather than concentrating development in the Kathmandu valley or in other urban areas only. The massive migration from other districts to urban areas is creating problems. Rural people do not seem to have much choice other than to migrate to urban areas. The success behind decentralization lies in building infrastructures like roads, well equipped hospitals and health posts, good schools, etc.

In the last decade, thousands of non-governmental organizations have emerged in the country, besides the existing international agencies. These organizations should honestly commit their programme implementation for the welfare of the local people by emphasizing income generating activities, health and sanitation training, family planning programmes, adult literacy, women's development programmes, and the like. The non-governmental programmes like the popular "barefoot doctors"[11] and the effective combination of traditional and Western medicine in treating as well as conveying health messages in China (Mosley, 1985) may be a good example. It is noteworthy that in those districts where more traditional birth attendants are trained and accessible, (e.g. Patan district), the infant mortality rate has dropped to 36 per 1000 live births (NPC/UNICEF, 1992).

From this study it is seen that nation-wide intensive family planning and immunization coverage is needed. Although family planning acceptors are on the increase every year, this programme is not very successful in Nepal for several reasons; one such reason being the preference for a son.

A previous feasibility study (Shrestha, 1980) found that the potential of using traditional faith-healers (believed to be 400,000 to 800,000 in number) as health messengers in the rural areas is very high. However, there is still a debate on this matter. The failure of public health care in rural Nepal is thought to be due to three reasons (Stone, 1986). They are: (a) people expect curative services rather than health education which does not provide sufficient curative services, (b) failure to see that indigenous health concepts can be linked to modern health messages in ways that would increase the relevance of these messages to the people, and (c) the misconception that faith-healers have control over their clients through their spiritual power, with the situation being otherwise in reality. Hence, a better strategy to convey health messages to the rural people without disrupting their traditional norms should be developed.

Another fact that emerges from this study is that women's education has to be strengthened with incentives to girls to attend schools, more job opportunities given to women, baby care provided at work place, maternity hospitals built in the rural areas, strict penalties imposed for those who violate the "minimum age at marriage" law, and nationwide training for traditional birth attendants or mid-wives. Emphasis should be given to adult literacy and non-formal education. In rural areas, school routines for formal and/or non-formal education should be made flexible or planned according to seasons. This is very important because during the planting and harvest period, attendance of students (especially that of the girls) is very low. Furthermore, school attendance is lower in the rainy season as well because of the slippery and muddy pathways. It is also worth looking at the reasons for women's reluctance to use family planning methods and not using hospitals to give birth to their babies.

There is substantial reduction in the trend of infant mortality from 1961 to 1991. The credit goes to the development factors such as socio-economic improvement, health care facilities, media, and awareness programmes conducted by government and non-government organizations. Like development itself, the reduction of infant mortality is slow and not very satisfactory.

A lot more effort is needed to bring about a drastic reduction in infant mortality by building a suitable infrastructure, and implementing development programmes without violating the cultural and traditional norms of the people. Commitment to development by the government and the people as well is very important.

Recommendations for Future Research

After assessing the limitations of the data and the research, some valuable observations emerged. People working in the villages have found that mature and elderly women enjoy educational programmes conducted in the villages. A study which measures the implications of the knowledge gained from such programmes and the outcomes should be implemented to assess their effect on infant mortality. A follow-up programme would be helpful for the assessment. While conducting any programme, the theme of it should be clear and the selection of such programmes should be done very carefully. Studies have shown that villagers have lost faith in the development programmes as some of them were either irrelevant to them or there were no follow-ups once the project was completed. For instance, the breastfeeding programme, which seems irrelevant in a country with 100 percent breastfeeding, could be modified by teaching how to develop sanitary habits including cleanliness of nipples and the reasons why lactating mothers should eat nutritious food.

To study the effect of sanitary habits on infant mortality, questions like whether people can afford soap, whether hands are washed before feeding the baby and after changing the diapers, and how much water is available for cleaning purposes in a day should be included along with the availability of clean water and toilets.

The traditional concepts, or rather misconcepts, which may have a direct or indirect effect on infant mortality are not revealed by the survey. For future investigations, questions such as which concepts affect the health of infants should be included. For instance, infants are restricted from drinking water or any other fluid when they have diarrhea. The misconception behind this practice is that while fluid is going out of the body, more liquid taken in would worsen the condition.

Ethnicity shows a strong influence on infant mortality even when effects of residence, parity, age at marriage, availability of clean water and flush toilets, prenatal and postnatal care, delivery assistance, and religion were controlled. This raises a question as to why one ethnic group has low infant mortality and another high with their different ethnic cultures, traditions, and beliefs. There may be several factors other than the one controlled (in logistic regression) which mediate to give this result. Even with an almost equal percentage of female literacy for both the groups, Newar infants have a higher chance of survival than do the Brahmin and Chhetri infants. An in-depth study of ethnicity and infant mortality in the future may resolve some of the questions raised here.

The prenatal care was found to be in an unexpected direction. The explanation provided in this study may not satisfy all the causes of and effects on infant mortality. A further study is recommended with factors such as the number of times the pregnant woman sought medical care, reasons for visit, and stage of pregnancy when medical care was sought.

The nutritional status of pregnant and lactating women, and of infants, are very important factors which affect the health of mothers and infants. It is strongly recommended that their influence on infant mortality be studied. This factor is also related to the birth weight of the newborns. Since many births take place at home, weighing newborn babies may seem absurd. A study concerning birth weights is suggested. The usual traditional birth attendants and the trained midwives of that area could cooperate in this field.

In the old days, the Nepalese believed that infants had a high risk of dying if the mothers had a history of infant/child loss. If this speculation were true, then a research question such as which variables mediate in this relationship and how they are mechanized may be fruitful for further study. Research studies have found that high fertility results in high infant mortality and vice versa. High parity associated with high infant mortality raises a question concerning whether this association is due to infant neglect, to malnutrition due to inadequate food distribution, or to mother's poor health as a result of frequent births. This question can be resolved only by further investigation.

Another important assertion is that generalization of any finding is not appropriate in a country like Nepal. This study discusses the general setup of the nation as a whole which may not be applicable in some cases. In-depth studies of specific groups or places may give more relevant results. Choosing places or people where infant mortality is very high or low; where educational level is very high or low (e.g. Sunsary is the only district where the female literacy rate (60.2 %) exceeds that of males (59.1 %)) may be excellent places for further research on infant mortality.

Missing cases was the major problem in this study. If "recall" was the problem in obtaining "number of months breastfed" or "grade in school", these factors may be related to some important event which occurred in that particular year or month. This may help the respondent to recall the months breastfed or grade in school. Analysis may be more revealing if it is done by qualitative methods such as participatory research.

NOTES

1. Urbanization is defined as a locality (a) with 20,000 or more inhabitants; (b) having electricity, roads, drinking water, communication and other minimum facilities (c) having a minimum annual revenue source of one million rupees; and (d) having a semi-urban environment. (Defined in "Nagarpalika Ain, 1992" as cited in Population Monograph of Nepal, 1995, page 242)
2. Acute Respiratory Infections are a group of upper and lower respiratory tract illnesses caused by bacterial, viral or fungal infections (Eubank, 1993).
3. Source for this Table is : Population Monograph of Nepal, 1995, pp 106, National Planning Secretariat, Central Bureau of Statistics, Kathmandu.
4. Source for this Table is : Population Monograph of Nepal, 1995, pp 113, National Planning Commission Secretariat, Central Bureau of Statistics, Kathmandu.
5. Muslims are an ethno-religious group in Nepal.
6. Ayurvedic practitioner, generally known as *Vaidya* or *Kaviraj*, is a *bona fide* medical professional. Ayurvedic medicine is based on a holistic approach to health and makes use of herbal and dietary formulations. There are Ayurvedic medical training institutions, hospitals and dispensaries, as part of the general health care system in South Asia, including Nepal. (Thapa, 1994: 190)
7. According to Hindu caste hierarchy, caste is classified into four classes as Brahman (intellectuals), Khastriya (warrior class), Vaishya (trader class), and Shudra (worker class), the classes descending from high to low, respectively. But

different ethnic groups aside from Brahmins and Chhetris and different religious groups have their own caste hierarchy.

8. This information was collected in a personal interview with Helen Huston from Edmonton, who served the people of Gurkha district, a rural hill area in Nepal, for thirty years until 1993.

9. Deaths associated with difficult labour and delivery, prematurity, small size, or obvious defects at birth are said to be "birth related". (Pandey et.al., 1991: 995)

10. Although infant caring is solely done by mothers in general, education of father may have some effect on the survival of infants. This effect may be due to better income and better information on health care leading to better decision making in terms of medical care. For these and other reasons, "education of father" is included in the analysis to study its effect on IMR.

11. Occupation "service" represents professionals, technicians, government officials, etc. in Nepal.

12. A *"guthi"* may be called a traditional community organization, practised from ancient times. It is formed with male members of a certain Newar ethnic subgroup who are related to one another. Most of the *"guthis"* subsist on joint land property or funding contributed by the *"guthi"* members.

13. Peasants in China called the younger commune members, who were given short training in both traditional and western medicine, "barefoot doctors". Their duties included treatment of minor ailments, the organization of health education programmes and the promotion of family planning (Yu, 1979).

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APPENDIX 1

Literacy Rate of Nepal by Ethnic groups, 1991

Ethnicity	Total	Literacy rate (%) Male	Female
Brahmin	62	78	47
Chhetri	46	64	28
Newar	61	74	48
Limbu	48	64	32
Rai	45	61	31
Gurung	47	62	35
Thakali	63	75	51
Tamang	29	42	16
Magar	40	57	25
Muslim	23	34	11
Sherpa	37	52	22
Kami	27	40	14
Sarki	25	38	13
Tharu	28	44	12
Nepal	39.6	54.5	25

Source: Population Census-1991, Central Bureau of Statistics, Kathmandu (1993).

APPENDIX 2

Estimates of Age-Specific Fertility Rates and Total Fertility Rates by Rural/Urban Residence, 1981 and 1991

Age Group	Rural		Urban	
	1981	1991	1981	1991
15-19	.0794	.0964	.0912	.0822
20-24	.2466	.2928	.2548	.2247
25-29	.2740	.2792	.2549	.1875
30-34	.2494	.2205	.2083	.1110
35-39	.2103	.1600	.1567	.0622
40-44	.1312	.0829	.0936	.0269
45-49	.0973	.0291	.0965	.0125
TFR	6.4	5.8	5.8	3.5

Source: Population Monograph of Nepal, 1995. National Planning Commission Secretariat, Central Bureau of Statistics, Kathmandu.

APPENDIX 3

Proportions Single by Age and Singulate Mean Age at Marriage for Nepal from 1971 to 1991

Age Group	1971 Female	1971 Male	1981 Female	1981 Male	1991 Female	1991 Male
10-14	.866	.937	.857	.851	.924	.958
15-19	.393	.730	.492	.741	.527	.794
20-24	.079	.331	.131	.409	.128	.381
25-29	.026	.123	.054	.195	.037	.127
30-34	.014	.057	.031	.124	.019	.052
35-39	.011	.033	.026	.089	.013	.028
40-44	.009	.023	.025	.080	.011	.021
45-49	.008	.016	.029	.074	.009	.016
50-54	.007	.014	.036	.069	.009	.016
Singulate Mean Age at Marriage	16.8	20.8	17.2	20.7	18.1	21.4

Source: Population Monograph of Nepal, 1995. National Planning Commission Secretariat, Central Bureau of Statistics, Kathmandu.

APPENDIX 4

Percentage Distribution of the Employed Population (Aged 10+ Years) by Major Occupational Groups for Rural and Urban Areas, Nepal, 1991

Major Occupational Groups	Rural			Urban		
	Both Sexes	Male	Female	Both Sexes	Male	Female
Professional and Technical	1.49	2.28	.37	5.68	5.13	7.45
Administrative and Related	.10	.16	.02	2.88	2.41	1.20
Clerical	.63	1.02	.08	6.72	7.45	4.37
Sales	1.98	2.51	1.24	16.19	17.64	11.57
Services	5.33	6.79	3.29	17.46	17.69	16.70
Agriculture	85.42	80.20	92.73	23.80	19.37	37.96
Production	3.16	4.41	1.41	18.35	19.49	14.70
Others	1.63	2.34	.62	8.30	9.20	5.42
Not Stated	.26	.27	.24	.62	.62	.62
Total	100.00	100.00	100.00	100.00	100.00	100.00
No.	6,824,978	983,7392	841,237	514,610	391,844	122,766

Source: Population Monograph of Nepal, 1995. National Planning Commission Secretariat, Central Bureau of Statistics, Kathmandu.

APPENDIX 5

Urban and Rural Population by Caste/Ethnic Group, Nepal, 1991

Urban Population			Rural Population		
Caste/Ethnic Group	Population ('000)	Percent	Caste/Ethnic Group	Population ('000)	Percent
Newar	410.2	24.2	Chhetri	2,752.7	16.4
Brahmin, hill	282.9	16.7	Brahmin, hill	2,105.6	12.5
Chhetri	215.4	12.7	Magar	1,284.0	7.6
Muslim	73.6	4.3	Tharu	1,153.4	6.9
Gurung	55.5	3.3	Tamang	963.8	5.7
Magar	55.3	3.3	Kami	923.2	5.5
Tamang	54.4	3.2	Yadav	736.4	4.4
Tharu	40.9	2.4	Newar	630.9	3.8
Kami	40.4	2.4	Muslim	579.5	3.5
Rai	34.1	2.0	Rai	491.5	2.9
Yadav	28.8	1.7	Gurung	393.7	2.3
Brahmin, Terai	22.5	1.3	Damai	346.8	2.1
Baniya	21.8	1.3	Limbu	283.0	1.7
Sudhi	21.3	1.2	Thakuri	278.3	1.7
Damai	21.2	1.2	Sarki	266.6	1.6
Thakuri	21.1	1.2	Teli	232.9	1.4
Marwadi	21.0	1.2	Chamar	197.3	1.2

Appendix 5
continued..

Teli	17.8	1.1	Kushwah	196.5	1.2
Others	257.7	12.1	Sanyasi	169.3	1.0
			Others	2810.0	16.7
Total	1,695.7	100.0	Total	16,795.4	100.0

Source: Population Monograph of Nepal, 1995. National Planning Commission Secretariat, Central Bureau of Statistics, Kathmandu.

APPENDIX 6

Literacy rates (for population 6 years of age and over), Nepal, 1961 to 1991

Residence	1961	1971	1981	1991
Urban	39.3	48.3	50.5	66.9
Rural	7.7	12.5	21.4	36.8
Total	8.9	13.9	23.3	39.6

Source: Population Monograph of Nepal, 1995. National Planning Commission Secretariat, Central Bureau of Statistics, Kathmandu.

APPENDIX 7

Literacy Rate for Urban and Rural Population, Nepal, 1991

Age group	Urban			Rural		
	Total	Male	Female	Total	Male	Female
06-09	47.0	55.7	38.0	44.7	53.7	35.3
10-14	63.2	76.0	49.3	61.2	74.8	46.6
15-19	54.7	71.5	38.6	51.8	69.6	35.0
20-29	70.6	82.9	57.8	35.8	56.5	18.1
30-39	61.2	76.0	44.5	26.2	44.0	9.4
40-49	52.3	69.6	31.7	20.1	35.6	5.0
50-59	42.2	60.0	21.9	15.6	27.1	3.0
60+yrs	32.2	50.8	14.2	12.4	22.1	2.4
All ages	66.9	78.0	54.8	36.8	51.9	22.0

Source: Population Monograph of Nepal, 1995. National Planning Commission Secretariat, Central Bureau of Statistics, Kathmandu.

APPENDIX 8

Socio-economic and Demographic Differentials in Infant Mortality, Nepal, 1962-1991

Variable	NFS 1976[1] (1962-71)	NFFS 1986[2] (1982-85)	NFHS 1991[3] (1981-91)
Education of mother			
No education	166	95	103
Some education	154	87	56
Education of father			
No education	170	89	-
Some education	152	105	-
Highest education in households			
No education	-	101	-
Primary (1-5)	-	88	-
Above (6+)	-	94	-
Sex of child			
Male	171	96	105
Female	161	94	91
Birth order			
1st	185	-	116
2-3rd	157	-	83
4-6th	163*[4]	-	92
7+	*	-	130
Maternal age			
Less than 20	216	105	137
20-29	162	86	88
30-39	142*	102*	94
40-49	*	*	99

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[1] Nepal Fertility Survey, 1976

[2] Nepal Fertility and Family Planning Survey, 1986

[3] Nepal Fertility and Health Survey, 1991

[4] * here shows the combination of two categories (e.g. 4-6th and 7th birth order).

Continued....

Variable		NFS 1976 (1962-71)	NFFS 1986 (1982-85)	NFHS 1991 (1981-91)
Previous birth interval				
NFS 1976	NFHS 1991			
<18 months	<2 years	236	-	155
18-35 mo	2-3 years	180	-	78
36+	4 yrs+	95	-	39
Antenatal/delivery care				
Not received		-	-	84
Received		-	-	55
Availability of latrine				
Flush, pan		-	*	28
Pit, other		-	89*	69
No facility		-	96	84

Source: Population Monograph of Nepal, 1995. National Planning Commission Secretariat, Central Bureau of Statistics.

APPENDIX 2

Trends in Age Specific Fertility Rates and Total Fertility Rates for Nepal from 1971 to 1991

Age group	1971	1974/75	1976[4]	1976[5]	1977/78	1981	1986	1991
15-19	.074	.116	.141	.145	.130	.066	.094	.095
20-24	.267	.270	.305	.290	.294	.230	.326	.286
25-29	.310	.297	.284	.295	.294	.266	.289	.272
30-34	.261	.260	.252	.269	.252	.245	.215	.212
35-39	.196	.169	.170	.169	.180	.206	.174	.151
40-44	.109	.089	.095	.075	.072	.142	.087	.077
45-49	.043	.050	.034	.023	.024	.099	.021	.028
TFR	6.3	6.3	6.4	6.3	6.2	6.3	6.0	5.6

Source: Population Monograph of Nepal, 1995. National Planning Commission Secretariat, Central Bureau of Statistics, Kathmandu.

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[4] Demographic Sample Survey, 1976

[5] Nepal Fertility Survey, 1976

APPENDIX 10

Zero-order correlation coefficient table for the independent variables

Variables	1	2	3	4	5	6	7	8	9	10	11
(1) Residence	1.0000										
(2) Education of mother	.3616	1.0000									
(3) Education of father	.1292	.1881	1.0000								
(4) Age at first marriage	.1022	.3948	.0331	1.0000							
(5) Parity	-.0877	-.1727	-.0190	-.2397	1.0000						
(6) Antenatal care	.2656	.1471	.0677	.1364	-.1136	1.000					
(7) Place of delivery	.3042	.2444	.0652	.1769	-.1223	.5750	1.0000				
(8) Delivery assistance	.3063	.2441	.0699	.1642	-.1329	.6103	.9131	1.000			
(9) Immunization	-.0365	.0737	.0014	.0416	.0050	.2918	.2459	.2590	1.0000		
(10) Standard of living	.0391	.2709	.0486	.1042	-.0595	.0676	.1436	.1443	.0075	1.0000	
(11) Mother's work place	.0417	.0302	-.0307	-.0550	-.0208	-.0857	-.0536	-.0712	.0085	-.0071	1.0000