

*Regional and Socio-Economic Differentials in
Infant and Child Mortality in Rural Nepal*

Bhakta B. Gubhaju
Nepal FP/MCH Project

Introduction

In the present paper I will examine infant and child mortality differentials in rural Nepal by geographic regions and socio-economic characteristics, which are known to have significant bearing on infant and child mortality. Geographic regions may not fully explain differentials in infant and child mortality. Apart from differences in climatic conditions, the differentials in fact may be manifestations of the different socio-economic conditions existing within the regions and different levels of availability of health services.

Framework for Analysis

Considerable mortality differentials have been observed not only between the developed and developing countries but also between geographic areas and various socio-economic subgroups of the individual country.

In Asian countries, several studies have examined infant and child mortality differentials by socio-economic factors. In a study based on the Bangladesh Fertility Survey it was confirmed that child mortality has an inverse relationship with socio-economic status (Mitra, 1979). In greater Bombay, social class was found to have strong impact on infant mortality in general and on postneonatal mortality in particular. The increased infant mortality rate in lower strata of society was attributed not to lack of health services, but to lack of knowledge, negligence and reluctance of low status mothers to approach public health services (Ruzicka and Kanitkar, 1973). In a cross-sectional study of 24 countries in the Asian and Pacific regions, Hashmi (1980) noted that the mortality level was highly sensitive to the socio-economic variables as well as to the medical and public health services. Behm and Vallin (1982) observed that population groups that have access to modern medical care, generally urban and living in better socio-economic conditions, have in general mortality rates lower than population groups depending mostly on traditional medicines or limited and low quality health care.

One of the most often used socio-economic variables in the study of infant and child mortality is the level of mother's education. There are numerous studies showing that maternal education plays an important role in determining level of infant and child mortality. The probability of dying from birth to age two by maternal education in a number of Latin American countries around 1966-71 shows that mortality probabilities decline almost linearly with an increase in the level of education.

Children of illiterate women have a risk 3.5 times greater than children of mothers with 10 or more years of education (Behm and Vallin, 1982). Palloni has found in Latin America that about 86 per cent of the variability in the risks of dying before age two was accounted for by the mother's educational level. He further indicated that a 10 per cent change in the measure of aggregate education implies a reduction of 1.2 deaths per 1000 children born to mothers in the average education category but over 5.6 deaths per 1000 in the lowest education category. Therefore, he argues that 'Social and economic factors related to the rate of adult literacy appear to be by far the most relevant; they are surely among those to be manipulated if any further improvements [of infant and early childhood mortality] are to be realized' (Palloni, 1981:645). Preston (1980) also observed for developing countries that a 10 per cent point increase in literacy is associated with a gain in life expectancy of approximately two years.

There is a large number of studies showing invariably a clear negative association between mother's education (in some instances, education of both parents) and infant or early childhood mortality (Ruzicka and Kanitkar, 1973; D'Souza, 1980; Mitra, 1979; Hashmi, 1980; Arriage, 1980). However, there has been no clear indication of how the link between mother's or parents' education and child mortality operates. In many studies the educational variable has been used or interpreted as a proxy for general standard of living of the family. The independent effect of education on child mortality has been pointed out and strongly emphasized by Caldwell as follows:

maternal education is the single most significant determinant of these marked differences in child mortality. These are also affected by a range of other socio-economic factors, but no other factor has the impact of maternal education and in their totality they do not even come close to explaining the effect of maternal education. Clearly, maternal education cannot be employed as a proxy for general social and economic change but must be examined as an important force in its own right. So important is it that it goes far towards mitigating the child mortality impact of the presence or absence of medical facilities in the area of residence (Caldwell, 1979:408).

Caldwell argues that '...education serves two roles: it increases skill and knowledge as well as the ability to deal with new ideas, and provides a vehicle for the import of a different culture' (Caldwell, 1979:408). He also argues that education makes women less 'fatalistic' about illness and more capable of manipulating the modern world; it also changes the traditional balance of familial relationships with profound effect on child care. In a later study, paternal education has also been shown to be important, though not as important as maternal education. Once maternal education was controlled, rural-urban differentials in infant and child mortality became trivial (Caldwell and McDonald, 1982).

A large number of the studies reviewed above have also indicated that variations in level of infant and child mortality are associated with many other socio-economic factors. But these studies have not paid much attention to the mechanisms by which the socio-economic variables actually operate. Only a few studies have so far analysed the effects of intervening variables to account for these associations. Using data from matched birth and death records of infants born in Baltimore city, Shah and Abbey (1971) found birth weight to be the most important factor in both neonatal and postneonatal mortality. In the neonatal period, socio-economic status was important only because of its relation to birth weight. However, in the postneonatal period, socio-economic status itself was also important. Brooks (1980) using data from Cleveland, Ohio, also argues that socio-economic status and infant mortality are associated through the intervening variable - low birth weight.

Mosely (1983) in an attempt to develop a conceptual framework for analysis of infant and child mortality demonstrated that all social and economic variables of child survival operate through some biological mechanisms that enhance or, in contrast, reduce the child's biological responses to adverse elements or conditions endangering its chances of survival. The biological mechanisms in the context of our study will remain 'unexplained' as we have no data suitable for in-depth analysis of such processes.

Most demographic surveys lack relevant information that would make it possible to investigate both socio-economic and biological variables in one analytical model. The Nepal Fertility Survey data is no exception to this. Hence, for the purpose of subsequent discussion I work only with socio-economic variables which are divided into two groups:

- a. Aggregate level - geographic regions (Terai, Hills and Mountains).
- b. Individual level - educational level of parents (or mother, as the latter may indicate the status in the family), and occupation of mother.

The present paper examines infant and child mortality differentials by geographic regions (aggregate level), and then by educational level of parents and occupation of mother (individual level).

Data Source and Methodology

This study is based on data from the Nepal Fertility Survey 1976 carried out by the Nepal Family Planning and Maternal Child Health Project in collaboration with the World Fertility Survey. The details of the survey methodology and sample design can be found in the Nepal Fertility Survey, First Report (Nepal Family Planning and Maternal Child Health Project, 1977). Although the major objective of the survey was to identify differentials in patterns of fertility and fertility regulation and to clarify factors affecting fertility, the information gathered from the pregnancy histories of ever-married women aged 15-49 also provides the most comprehensive and detailed set of data suitable to examine infant

and child mortality by geographic regions and socio-economic characteristics of the parents. The present study is mainly confined to the rural areas of Nepal: of the 5940 women there were 5802 women interviewed in the rural sample.

For the purpose of this study infant mortality is measured as the probability of dying of a cohort of live births before reaching age one, and child mortality (1 - 4 years of age), in turn, is measured as the probability of dying before age five for these of the cohort of births that survived to age one.

In order to calculate the probabilities of dying between birth and age one, and between ages one and five, I excluded from the analysis all children who were born less than five years before the survey to eliminate the effect of truncation. Because of the uncertainty about completeness of reports on births and deaths that occurred in the remote past I excluded from the analysis births that occurred 15 or more years before the survey. In addition, children born more than 15 years before the survey would have a high proportion of those born to younger women; such births are known to be associated with high risk of infant and child death and their inclusion would overestimate the past mortality levels. Thus the present analysis includes the cohorts of children born in 1962-71.

Differentials in Infant and Child Mortality in Rural Areas of Nepal

In this section I first present estimates of infant and child mortality in the rural areas of the Terai, Hills and Mountains for the cohorts of children born in 1962-66 and in 1967-71. This will enable to examine the differentials and time trends in infant and child mortality at the aggregate level. Secondly, at the individual level analysis, I will include selected socio-economic characteristics of the parents such as education of mother and father and occupation of mother, which will provide some idea of the impact of social stratification on infant and child mortality differentials in the rural areas of the Terai, Hills and Mountains.

Regional Differentials in Infant and Child Mortality

Table 1 presents the infant and child mortality rates in Terai, Hills, and Mountains for the cohort of children born in 1962-66 and 1967-71. A simple ratio of these rates is also presented to show the extent of regional variations in infant and child mortality.

Table 1 shows that for the cohort born in 1962-66, the rural infant mortality rate was highest in the Terai region, 206 per 1000, followed closely by 203 in the Mountains and 153 in the Hills. This pattern was somewhat changed for cohort born in 1967-71: the rates were 180 per 1000 in the Mountains, 168 in the Terai and 147 in the Hills. The extent of regional differentials in infant mortality has been somewhat reduced for the latter cohort from a ratio of 1.3 between the highest and the lowest mortality to 1.1. Similarly, child mortality (1-4 years of age) for the

1962-66 cohort was highest in the Mountains, 159 per 1000, followed by 141 in the Terai and 98 in the Hills. For the 1967-71 cohort the pattern of child mortality differentials remained the same: it was once again highest in the Mountains, 143 per 1000, but in the Terai (101) and Hills (100) the rates were virtually the same. As in the case of infant mortality, the regional differentials in child mortality were larger for the earlier cohort, 1962-66 than for the 1967-71 birth cohort.

Table 1

Infant and Child Mortality Rates by Geographic Region and Birth Cohort,
Rural Nepal

Region	Infant Mortality per 1000		Child Mortality per 1000	
	1962-66	1967-71	1962-66	1967-71
Terai	206(1433)	168(2008)	141(1138)	101(1671)
Hill	153(1897)	147(2478)	98(1606)	100(2114)
Mountain	203(291)	180(367)	159(232)	143(301)
Ratio				
Terai/Hill	1.34	1.14	1.44	1.01
Mountain/ Hill	1.33	1.22	1.62	1.42

Note: Figures in parentheses are number of live births for infant mortality and number of children that survived to age one year for child mortality.

Source: Nepal Fertility Survey 1976

There has been, in general, a decline in infant and child mortality in rural areas of Nepal during the decade 1962-71. It was much more noticeable in the Terai region; infant mortality declined from 206 to 168 per 1000 and child mortality from 141 to 101 per 1000 between these two birth cohorts. The Mountain region experienced a more moderate decline; from 203 to 180 per 1000 for infant mortality and 159 to 143 per 1000 for child mortality. In contrast, the Hill region experienced only a little or no decline during these periods; infant mortality rates were 153 and 147 per 1000 and child mortality rates 98 and 100 per 1000 for the 1962-66 and 1967-71 cohorts respectively.

The faster decline in infant and child mortality observed in the Terai may be related to the development of public health programmes. Although the malaria eradication programme began in 1958, it was not fully in operation in the whole of the Terai. In this context Gaige noted:

Although malaria eradication began in some of the more populous parts of the Central and Mid-Eastern Tarai in the Mid-1950's, intensive DDT spraying of the entire Central and Mid-Western Tarai did not begin until March, 1960. In the Mid-Western districts it began in March, 1963, in the far eastern districts in March, 1964, and in the far western districts in November, 1965 (Gaige, 1970: 208-209).

Therefore, the malaria eradication programme can, in part, account for reducing infant and child mortality in the Terai between 1962-71. The Hill region was free from malaria, and infant and child mortality rates were initially at comparatively lower levels. The lack of significant improvement of socio-economic conditions in the Hills can be associated with the slower pace of decline in both infant and child mortality. The persistently higher infant and child mortality levels in the Mountains may be due to the lack of improvement in health services and low level of socio-economic development. It can also be conjectured that the higher infant and child mortality in the Mountains may be due to some biological factors such as low birth weight. This study does not provide data to support this conjecture, but it may be supported by other relevant studies. Pawson (1977) reviewed several studies and showed that children born and raised above 3500 metres exhibited decreased birth weight and slower growth rates compared to children born at sea level. Data for highland resident in the United States suggested a positive correlation between neonatal mortality and altitude, perhaps related to lower birth weight and increased frequency of premature births. A similar pattern was exhibited among Andean populations with long histories of high altitude residence (Weitz et. al., 1974). Bangham and Sacherer (1980) also observed a higher male childhood mortality rate among high altitude populations in Nepal related to the lower birth weight, because of a greater number of male births with birth weight less than 2500 grams.

Socio-Economic Differentials in Infant and Child Mortality

The preceding section has revealed regional variations in infant and child mortality at an aggregate level, and it was suggested that the differences may be related to variations in general socio-economic conditions and provision of public health and medical services. Infant and child mortality rates, however, depend also on the individual characteristics of the parents. Given similar availability of health services, the individual socio-economic characteristics of the parents may play an important role in infant and child mortality. The present section examines the effect of three socio-economic characteristics of the parent on infant and child mortality differentials in the rural areas of the Terai, Hills and Mountains. Because of small sample size in some of the categories the two birth cohorts have been combined in one, namely all children born in the decade of 1962-71.

Table 2 presents the infant mortality rates in the rural areas of

the Terai, Hills and Mountains by the characteristics of the parents: education of mother, education of father and occupation of mother. As the 'some education' group, particularly of the mothers, represents a small fraction of the study population one needs to be cautious in the interpretation of the results; when dealing with small cell size, errors in the reporting of even one or two deaths can produce large fluctuations in the rates. Therefore, small differences in the rates pertaining to small cell size may not be genuine.

Table 2

Infant Mortality Rates (per 1000) by Socio-Economic Characteristic and Geographic Region, Rural Nepal

Characteristic	Terai	Hill	Mountain	Total
Education of Mother				
1. No Education	183(3325)	149(4318)	191(654)	166(8297)
2. Some Education	207(116)	175(57)	* (4)	192(177)
Education of Father				
1. No Education	189(2531)	151(3567)	193(555)	169(6653)
2. Some Education	169(910)	142(808)	175(103)	158(1821)
Mothers Work Aside from Housework				
1. Work	205(1436)	151(3917)	192(645)	168(5998)
2. Do not work	168(2003)	141(454)	* (13)	163(2470)

* Number of cases too small.

Note: Figures in parentheses are number of live births.

Source: Nepal Fertility Survey 1976.

Table 2 shows that when education of mother is considered the regional pattern of infant mortality still persists; the Mountains having highest infant mortality followed by the Terai and Hills. However, in contrast to the findings from other studies, mothers with 'some education' appear to have experienced a higher infant mortality rate than those with 'no education'. Considering the number of births involved in the calculation and the fact that the category 'some education' consists largely of women with less than completed primary education the difference can by no means be taken as invalidating the generally recognized negative association between mother's education and infant mortality.

In the case of father's education, infant mortality is slightly higher (169 per 1000) among children of fathers with 'no education' than those with 'some education' (158 per 1000). The breakdown by regions also reveals that in all the three regions the infant mortality rate is higher among children whose fathers have 'no education' than

those whose fathers have 'some education' Except for the Mountains, the sample size is fairly large, and, hence, the result that father's education has some impact in lowering infant mortality in rural Nepal may be accepted with confidence.

It is also revealed in this table that infant mortality, in general, does not differ much between children of mothers who work aside from housework (168 per 1000) and those who do not work (163 per 1000). However, in the Terai region, mothers who work have substantially higher infant mortality (205 per 1000) than those who do not work, (168 per 1000). It is to be noted that almost all women working outside home in the Hills and Mountains attend to farm work. This probably does not interfere with their caring for an infant.

Now let us examine the effect of the individual socio-economic characteristics of the parents on child mortality. A large number of studies have shown that the individual characteristics of the parents have a more substantial effect on child mortality than on infant mortality in particular to Nepal where breastfeeding extends over prolonged period well in excess of 12 months.

Table 3

Child Mortality Rates (per 1000) by Socio-Economic Characteristic and Geographic Region, Rural Nepal

Characteristic	Terai	Hill	Mountain	Total
Education of Mother				
1. No Education	119(2717)	100(3673)	151(529)	111(6919)
2. Some Education	54(92)	64(47)	* (4)	56(143)
Education of Father				
1. No Education	128(2053)	101(3027)	161(448)	116(5528)
2. Some Education	89(756)	92(693)	94(85)	91(1534)
Mothers Work Aside from Aside				
1. Work	120(1142)	103(3326)	150(521)	111(4989)
2. Do not work	115(1666)	72(390)	* (12)	107(2068)

* Number of cases too small.

Note: Figures in parentheses are number of children that survived to age one year.

Source: Nepal Fertility Survey 1976.

Table 3 presents the child mortality rates in the rural areas of the Terai, Hills and Mountains by education of mother, education of father and occupation of mother. Child mortality rate is reduced to one-half

among children whose mothers have some education compared to those whose mothers have no education. These differences persist for the Terai and Hill regions. Here again the problem of sample size in the category of mothers with 'some education' makes us skeptical of reaching any firm conclusion. However, in view of the magnitude of the differences, we are inclined to accept them as real with respect to the direction of the differential even if the magnitude may be less reliable.

Education of father is also found to have some impact on child mortality. The child mortality rate is lower (91 per 1000) among children whose fathers have some education than those whose fathers have no education (116 per 1000). This pattern persisted in all the three regions. However, the differentials by father's education are much less compared to mother's education. It is also interesting to note that when fathers with 'some education' are considered, the regional differentials in child mortality virtually disappear; the rates are 89, 92 and 94 per 1000 in the Terai, Hills and Mountains, respectively.

As with infant mortality, child mortality does not differ much between children of mothers who work aside from housework (111 per 1000) and mothers who do not work (107 per 1000). However, in the Hills, mothers who work experienced considerably higher child mortality (103 per 1000) than those who do not work (72 per 1000). A similar result was found in Sudan where children of working mothers had higher mortality than children of housewives (Farah and Preston, 1982). The explanation Farah and Preston advanced was that children of working mothers were deprived of adequate child care. This may be the case in Nepal as well but there are no data to support this.

Conclusion

This paper has examined infant and child mortality differentials at aggregate and individual levels. The aggregate analysis considered geographic regions, namely the rural areas of the Terai, Hills and Mountains. The individual level analysis included three socio-economic characteristics of the parents for which the Nepal Fertility Survey provided information, namely education of mother, education of father and occupation of mother. The analysis were carried out for infant and child mortality separately.

The regional differentials in infant and child mortality have been examined for two birth cohorts, children born in 1962-66 and 1967-71. It is shown that the Mountain regions have the highest infant and child mortality followed by the Terai and Hills. The persistently higher level of mortality in the Mountains has been attributed to the low level of socio-economic development and lack of general health services there.

The time trend in infant and child mortality revealed a general decline in rural mortality: the extent of variation in the rates, particularly of the Hill-Terai differentials, was much larger for the earlier birth cohort, and has been substantially reduced for the latter birth cohort. The Terai regions experienced a noticeable decline in infant and

child mortality between these periods. This is probably due to the fact that in the Terai region, in the past, malaria had a high prevalence. The malaria eradication programme has been able to assist in bringing down the level of infant and child mortality quite substantially. The Hill region was free from malaria and infant and child mortality was initially at a relatively lower level compared to the Terai. The lack of substantial improvement in general socio-economic development in the Hills may account for the slower pace of decline in infant and child mortality.

At the individual level analysis, the data for the two cohorts have been combined because of the problem of small cell sizes in some of the categories. It has been found that mother's education does not seem to have affected infant mortality, but, rather, the differences, although rather small, was in the opposite direction than expected. The small number of births in that educational category of mothers and the fact that most of them had less than completed primary education makes it difficult to interpret the result with confidence. However, father's education has shown some reducing impact on infant mortality. Infant mortality did not differ much between mothers who work aside from housework and those who do not work. However, in the Terai, mothers who work aside from housework have substantially higher infant mortality than those who do not work.

There is a greater conformity with other studies with respect to socio-economic differentials in child mortality in rural Nepal. It has been shown that child mortality was substantially lower among children of mothers with some education than those of mothers with no education. Mothers with no education have experienced child mortality that was twice as high as for those with some education. Child mortality was also lower among children whose fathers have some education than those whose fathers have no education. But the differentials were not as large as those in the case of mother's education.

Although child mortality, in general, did not differ much between children of mothers who work aside from housework and those who do not work, in the Hills it was found to be higher among children of working than of non-working mothers. This may be due to some degree to the probability that children of working mothers are deprived of adequate care.

ACKNOWLEDGEMENTS

This research was carried out while the author was a research scholar at the Department of Demography, Australian National University, Canberra. The author wishes to thank Dr. L.T. Ruzicka and Dr. T.H. Hull for their valuable suggestions in the preparation of this paper.

REFERENCES

- Arriaga, E.E., 1980. "Infant and Child Mortality in Selected Asian Countries." *Proceedings of the Meeting on Socioeconomic Determinants and Consequences of Mortality, Mexico City, 19-25 June 1979* (UN, New York/WHO, Geneva, 1980), pp. 98-118.

- Bangham, C.R.M. and J.M. Sacherer. 1980. "Fertility of Nepalese Sherpas at Moderate Altitudes: Comparison with High-Altitude Data." *Annals of Human Biology* 7, No. 4, 323-330.
- Behm, H. and J. Vallin. 1982. "Mortality Differentials Among Human Groups." In S.H. Preston (ed.), *Biological and Social Aspects of Mortality and the Length of Life*. (Ordina Editions, Liege, 1982), pp. 11-37.
- Brooks, C.H. 1980. "Social, Economic and Biological Correlates of Infant Mortality in City Neighborhood." *Journal of Health and Social Behavior* 21, 2-11.
- Caldwell, J.C. 1979. "Education as a Factor in Mortality Decline: An Examination of Nigerian Data." *Population Studies* 33, No. 3, 395-413.
- Caldwell, J.C. and P.F. McDonald. 1982. "Influence of Maternal Education on Infant and Child Mortality: Levels and causes." *Health Policy and Education* 2, 251-267.
- D'Souza, S., A. Bhuiya and M. Rahman. 1980. "Socio-Economic Differentials in Mortality in a Rural Area of Bangladesh." *Scientific Report*, No. 40, ICDDR,B, Dacca.
- Farah, A. and S.H. Preston. 1982. "Child Mortality Differentials in Sudan." *Population and Development Review* 8, No. 2, 365-383.
- Gaige, F.H. 1970. "National Integration in Nepal: A Study of the Nepal Tarai." Ph.D. Dissertation, University of Pennsylvania.
- Hashmi, S.S. 1980. "Socioeconomic Determinants of Mortality Levels in Asia and the Pacific." *Proceedings of the Meetings on Socio-economic Determinants and Consequences of Mortality, Mexico City, 19-25 June 1979* (UN, New York/WHO, Geneva, 1980), pp. 119-136.
- Mitra, S.N. 1979. "Infant and Childhood Mortality in Bangladesh: Levels and Differentials." M.A. Thesis, Australian National University.
- Mosley, W.H. 1983. "Will Primary Health Care Reduce Infant and Child Mortality? A Critique of Some Current Strategies, with Special Reference to Africa and Asia." Paper Prepared for the IUSSP Seminar on Social Policy, Health Policy and Mortality Prospects, Paris, 28 February 4 March 1983 (mimeo).
- Nepal Family Planning and Maternal Child Health Project. 1977. *Nepal Fertility Survey 1976: First Report*. Kathmandu: His Majesty's Government, Ministry of Health.
- Palloni, A. 1981. "Mortality in Latin America: Emerging Patterns." *Population and Development Review* 7, No. 4, 623-649.

- Pawson, I.G. 1977. "Growth Characteristics of Populations of Tibetan Origin in Nepal." *American Journal of Physical Anthropology* 47, No. 3, 473-482.
- Preston, S.H. 1980. "Causes and Consequences of Mortality Declines in Less Developed Countries During the Twentieth Century." In R.A. Easterlin (ed.), *Population and Economic Change in Developing Countries*. (University of Chicago Press, Illinois, 1980), pp. 289-360.
- Ruzicka, L.T. and T. Kanitkar. 1973. "Infant Mortality in Greater Bombay." *Demography India* 11, No. 1, 41-55.
- Shah, F.K. and H. Abbey. 1971. "Effects of Some Factors on Neonatal and Postneonatal Mortality: Analysis by a Binary Variable Multiple Regression Method." *The Milbank Memorial Fund Quarterly* 49, No. 1, 33-57.
- Weitz, C.A., M.V. Weitz, I.G. Pawson, S. Lang and A. Lang. 1974. "Fertility in a Highland Nepalese Population." (Summary), *American Journal of Physical Anthropology* 40, No. 1, 156.