DETERMINANTS OF INFANT AND CHILD MORTALITY IN MONGOLIA

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CHAPTER 1. INTRODUCTION

1.1 Measures of infant and child mortality

Reduction of infant and child mortality is a key development goal. Thus it is an area that has attracted the attention of policy-makers and program implementers worldwide.

The World Summit for Children, held in 1990, set forth a package of objectives to be implemented by the year 2000. Among these objectives was an aim to reduce infant and under-five mortality by one third, or to 50 and 70 deaths per 1,000 births, respectively, whichever is less. This was reaffirmed at the 1994 International Conference on Population and Development (ICPD). The 1996 population policy of Mongolia announced the intention to reduce the mortality rates of infants and children under five years of age by one third from the level of 1990 by the period 2010-2015.

To understand infant and child mortality it is important to have a clear distinction between deaths which occur at different points of time. Mortality rates presented in this paper are the probability of death prior to a certain age. For example, the early neonatal and neonatal mortality rates are calculated as the probability of dying during the first week and month of life, respectively. The infant mortality rate is the probability of dying before the first birthday. Child mortality is the probability of dying between the first and fifth birthdays, while the under-five mortality rate is the probability of dying between birth and the fifth birthday.

Infant mortality is a customary measure of survival in early life but it excludes the largest component of reproductive mortality which is stillbirth. Stillbirth is a death occurring in the 28th-40th week of foetal life.

There remains a clear distinction between the determinants of infant and child mortality. Infant mortality, and especially neonatal mortality, is conditioned by the circumstances of childbirth, environmental circumstances of the mother prior to birth and the influence of breastfeeding while child mortality is mostly conditioned by environmental factors.

1.2 The country

Mongolia is situated at the center of Asia, between the Russian Federation to the north and the People's Republic of China to the east, south and west. A little over 95 percent of the population is Mongolian and 78.8 percent out of it belongs to Khalkh ethnic group. According to the 2000 population and housing census, the resident population of Mongolia stood at 2,373.5 thousand, with 56.6 percent of the population residing in the urban areas and the remaining 43.4 percent in the rural areas. Unlike some other Asian countries, women’s labour force participation is high in Mongolia. At the time of the 2000 census, 46.3 percent of women aged 15 and over were employed. Similarly, in terms of literacy and educational level women are almost the same or even better than men in Mongolia. According to 2000 census, literacy rate is 98 and 97.5 percent for men and women aged 15 and above, respectively. By 5 January 2000, 7.6 and 7.7 percent of men and women aged 10 and above, have university degree or higher education, respectively. Similarly, 56.9 and 57.7 percent of men and women aged 10 and above, respectively, have completed secondary and non-degree tertiary education.

Fertility has been decreasing in Mongolia since the late 1980s and the decline has accelerated during the transition period from a command to a market economy. For example, Crude Birth Rate (CBR) decreased from 36.5 in 1989 to 20.4 in 1999. At the same time, Crude Death Rate (CDR) declined from 8.4 to 6.6 and infant mortality has been declining. However, maternal death has not been decreasing. In 1990 and 1999, there were 89 and 90 maternal deaths, respectively, in the country (NSO, 1990, 2000). But infant mortality has been declining.

1.3 Objectives

Since reduction of infant and child mortality is a worldwide issue, many researchers have been studying the underlying causes, mechanisms and differentials of such mortality. This study aims to investigate differentials and determinants of early neonatal, neonatal, infant, child and under-five mortality for Mongolia. This paper will also attempt to find some explanations for the differences between the estimations of infant mortality rates derived from the Reproductive Health Survey (RHS) conducted in 1998 and the vital registration.

1.4 Data source

In 1998, the RHS was conducted for the first time in Mongolia by the National Statistical Office (NSO) of Mongolia with the financial support from the United Nations Population Fund (UNFPA). One of the objectives of the RHS was to gather information on infant and child mortality. For the survey 6,005 households, 1.13 percent of all households in the country, were selected and 6,003 households were actually interviewed. Similarly, 7,553 women aged 15-49 were selected for individual interviews and 7,461 women were interviewed; and 1,560 husbands were selected and 1,557 husbands were interviewed. In short, coverage was good and the quality of data collected by the RHS is excellent (NSO and UNFPA, 1999).

In order to avoid difficulties from under-reporting of births and deaths that occurred a long time ago, only births that occurred in the ten years preceding the survey, but excluding births that occurred in the past one year, were selected for this study. Births that occurred in the past one year were excluded to avoid from censoring cases.

1.5 Determinants of infant and child mortality, relationships and interactions

Child survival is affected by community, household and individual characteristics. Community characteristics include: health care availability, prevalence of water, electricity, and sewage connections, existence of garbage disposal services and availability of education services. Household and individual characteristics include: mother's characteristics such as education, current and childhood place of residence; husband's characteristics such as education and occupation, and household characteristics, such as housing facilities and income. "Death clustering" is an expression introduced by Gupta (1990). High risk families are more exposed to short birth intervals and are likely to reach high parities in their attempts to achieve their desired family size, thus one implication of heterogeneity in child loss could be a rise in the overall level of fertility in this population. On average, some families are at higher risk than others but it can not be concluded that this risk is equally distributed among all siblings in a family (Ronsmans, 1995).

The determinants of infant death are classified as intrinsic (endogenous or biological or bio-demographic) and extrinsic (exogenous or environmental). Endogenous infant mortality is approximately equivalent to neonatal death (Wrigley, 1977) and it is more likely to implicate prenatal causes linked to maternal health; "luck of the genetic draw", or birth trauma, congenital defects and functional inadequacy. Exogenous infant mortality encompasses extrinsic causes, with infectious disease the major medical risk factor. Historical demographers have used the concept of endogenous infant death. Today's neonatal definition is more inclusive than the concept of endogenous infant death; it is a simple count of all deaths in the first month. It does not necessarily mean that all deaths in the first 30 days of independent life are due only to endogenous factors.

Endogenous (biological or bio-demographic) factors include such factors as sex, maternal age, number of previous births, space between births, birth weight and breastfeeding.

In the absence of discriminatory allocation of resources and care, male children experience higher mortality than female children. However, in large areas of Western South Asia, stretching across Pakistan and the northern states of India to Bangladesh, early-age death rates are often very much higher for females, especially in rural areas (Dyson, 1982). In these countries, treatment and resources of children during illness varies by sex.

Considerable evidence indicates the harmful consequences for child survival of childbearing at younger and older maternal ages (Hobcraft, McDonald, and Rutstein, 1985). Children born to teenage mothers generally experience considerable excess risks.

Mortality is generally higher for first-born children, especially during the first year of life. On the other hand, studies show that child mortality increases with the increase in parity after the second birth. The higher the parity, the shorter the birth interval, and the shorter the birth interval the higher the risk of dying for a child. The risk of dying is considerably higher for a child who has a sibling born within the preceding two years (Hobcraft, et al., 1983). Short birth interval has indirect effects through such factors as mother's depletion, premature birth and limited family resources. However, maternal age and birth order effects have been shown to be weaker than the effect of child spacing (Hobcraft, et al., 1985).

Low birth-weight infants are more likely to experience infant or child mortality than others. Singletons have a better chance of surviving than multiple births.

A shorter duration of breastfeeding has an indirect effect on infant mortality and thus increases the risk of death during childhood.

Exogenous (environmental or socio-economic) determinants include such factors as residence, mother’s and husband’s education, marital status of mother, mother’s occupation, water and toilet facilities and health service availability.

In general, aggregate infant and child mortality is lower in urban areas than in rural areas. However, mortality rates in slum areas of large cities appear to be higher than in rural areas. Primary towns, particularly capital cities, contain a concentration of medical facilities and have much better provision for piped water and sanitation.

Maternal education has been identified as one of the most important socio-economic determinants of infant and child mortality. Studies show that the higher the level of maternal education the lower the infant and child mortality. Caldwell (1981) provided three explanations for the phenomenon; more educated mothers become less fatalistic about their children's illnesses, they are more capable of manipulating available health facilities and personnel and they greatly change the traditional balance of familial relationships with profound effects on child care. In addition to these, they are more likely to have received antenatal care, to have given birth with some medical attendance, and to have taken their children at some time to see a physician (Caldwell, 1981 and Dyson, 1981).

Studies tend to indicate that for a given amount of maternal education, levels of early age mortality drop faster in urban than in rural areas (Arriaga, 1979). Education of a woman increases her status in a family. Caldwell also argues that in most cultures the central role of mass formal education has probably been underestimated in explaining mortality and fertility transitions and their timing. Well-educated mothers tend to purchase more health care, have better understanding of factors that affect their children's health and have a greater ability to implement medical advice and to purchase better nutrition.

Both paternal and maternal education levels appear to be much more influential than, say, the employment status of the mother (Hobcraft et al., 1982). Scholars argue that the relationship between maternal occupation and early-age mortality is not clear. Work provides independent income for women and improves their autonomy. On the other hand, it impedes mother-child contact and takes time away from the child.

Poor water and toilet facilities tend to increase infant and child mortality. For example, in an inter-American study the incidence of diarrheal disease was lowest in households having piped drinking water and flush toilet facilities. Current access to proper toilet facilities was found to influence infant mortality, especially beyond the post-neonatal stage (Hobcraft, 1981). In Brazil, household toilet facilities are related very weakly to child mortality risks. However, in other parts of the developing world, sanitation facilities have been found to be more important than water supply in reducing mortality levels. Improvement of water supply and quality of sanitation are important for decreasing mortality (Sastry, 1996).

Dyson argues that availability of health services can result in quite sizeable reductions in mortality, but they may have little effect outside their immediate localities. The absence of in-patient facilities is associated with a seven-fold increase in the risk of death. This indicates the great importance of establishing a basic level of health service in a community.

There are substitutive and complementary relationships between community and individual/household characteristics. Although the availability of health, sanitation and other social services is important for reducing child mortality, their interactions with individual and household characteristics determine the actual outcomes (Mosley and Chen, 1984).

Substitutability occurs when current variable effects are in the opposite direction of change of another variable. Complementarity occurs when current variable effects are in the same direction of change of another variable. With the improvement or increase of one variable, in case of substitutability, high risk categories of the other variable benefit but in case of complementarity, all categories of the other variable benefit.

Community water supply, household toilet facilities and access to health care may be either substitutes or complements to maternal education. With the exception of household electricity connections, community infrastructure variables emerge as substitutes for maternal education. Better conditions of water supply and sanitation are associated with lower mortality for children of less well-educated mothers but with significantly lower mortality for the children of better-educated mothers (Sastry, 1996).

1.6 Methodology

Life table analysis (also known as survival analysis) is used to estimate mortality rates by sex of child, mother’s age at birth, weight at birth, mother’s current and previous places of residence, mother’s educational level, husband’s educational level and employment, kind of accommodation, use of electricity, bathroom and toilet facilities, whether mother reads a newspaper, listens to the radio and watches television and the fastest way to request medical assistance in an emergency. Also sex differentials in neonatal and infant mortality rates are calculated by mother's current place of residence, mother's educational level and kind of accommodation. Similarly, neonatal and infant mortality rates are calculated by cross classifying mother's educational level with other variables such as husband's educational level, kind of accommodation and use of electricity. All mother's and mother's husband's socio-economic characteristics refer to the time of survey. Life table analysis is applicable to any phenomena where the duration of exposure is dependent on whether the event has terminated (death of child). The outcome of interest is the survival time, that is, the time from entry into the population at the risk of experiencing the event of interest to the time of experiencing the event (age at death) or the time of the interview if one has not yet experienced the event (age of child if child is living).

For death of child, the time variable is derived by creating a variable equal to the current age or age at which the respondent experienced a terminating event if the child has already died. In the survival analysis, a censoring variable takes the value of 0 if death has not occurred and the value of 1 if otherwise. The probabilities of dying by the 1st, 12th and 60th months are extracted from these life tables. Life tables are calculated using a Statistical Package for the Social Science (SPSS). Nine-year rates, including births that occurred in the past ten years before the survey but excluding births that occurred in the past one year, are utilized for studying differential mortality in order to assure statistical reliability.

Logistic models are used to estimate the odds of a child dying before reaching a certain age after controlling for other demographic and socio-economic variables which are known to affect the odds of neonatal and infant mortality. Logistic regression is used where the dependent variable is dichotomous, that is either 0 or 1. In this study the dependent variable takes the value of 1 if a child dies before reaching a certain age and the value of 0 if otherwise.

CHAPTER 2. TRENDS AND DIFFERENTIALS OF CHILD MORTALITY

This chapter presents mortality rates by selected bio-demographic and socio-economic variables obtained from life table analysis.

Table 1 presents early neonatal, neonatal, infant, child and under-five mortality rates for the two five-year and ten year periods preceding the survey. All rates provided in Table 1, except for early neonatal mortality, were presented in the 1998 RHS report. Infant, child and under-five mortality rates declined in the last five-year period compared with the previous five-year period. In the 1998 RHS report, it was argued that the apparent increase in neonatal mortality may be due to under-reporting of early deaths that occurred in the more distant past, which would lead to an under-estimation of the real decline in infant mortality. Similarly, the early neonatal mortality rate appears to have increased in the last five-year period compared with the previous five-year period. In the last five-year period, about 26 children per 1,000 live born children died before reaching seven days of life. About 75 percent of children who died before reaching the first month of life died before reaching seven days of life. In the ten years period preceding the survey, about 68 children per 1,000 live born children died before reaching their first birthday. About 77 percent of children who died before reaching age five died before reaching age one. Almost 47 percent of children who died before attaining one year of life died before attaining one month of life. Similarly, 73 percent of children who died before reaching one month of life died before reaching seven days of life.

Table 2 presents early neonatal, neonatal, infant, child and under-five mortality rates by sex, mother's age at birth, birth order, birth interval and weight at birth. As elsewhere in the world, except for example, what was found in South Asia (Dyson, 1982), male children are more likely to die than female children in Mongolia. Of the male and female children who died before reaching one month of life, about 63 percent and 68 percent, respectively, died before reaching seven days of life.

This study found that children born to very young and very old mothers are more likely to die and these are consistent with those of Hobcraft, McDonald and Rutstein (1985). According to Table 2, mortality at all ages, except child and under-five mortality, is lowest among children born to mothers aged 25-29. Early neonatal mortality is higher for children who were born to mothers aged 15-19 (30 deaths per 1,000 births) and 35-39 (35 deaths per 1,000 births) compared with those who were born to mothers aged 25-29 (20 deaths per 1,000 births). Neonatal mortality is higher by 16 and 19 points for children born to mothers aged 15-19 and 35-39, respectively, than those infants who were born to mothers aged 25-29. Both infant and under-five mortality were highest for children born to mothers aged 15-19. Moreover, the study on maternal and child health based on the 1998 RHS (paper 1 of this report) found that children of young and single mothers were more likely to suffer from childhood illness. Effective programs to reduce teenage childbearing would lower infant and child mortality.

Results by birth order indicated that mortality is high among those who were born at higher parities and the first-born child has higher risk of dying compared with the second and third births. Infant and under-five mortality rates are higher by 19 and 35 points, respectively, for children who were born at seventh or higher orders than those who were first-born.

The length of the birth interval is a very important factor for the survival status of infants and children. If the length of the birth interval is short the probability of dying is very high. The probability of dying before age five for children born less than two years after a previous birth is more than double that for those children born four or more years after a previous birth (NSO and UNFPA, 1999). This finding is in line with results what was found by Hobcrarft, Mcdonald and Rutstein (1983).

In line with results found elsewhere, mortality decreases with increase in weight at birth of a child. The early neonatal mortality rate is 30 points higher for infants born at less than 2,500 grams compared with those infants who were born weighing more than 3,600 grams. Infant mortality is higher (162 deaths per 1,000 births) for children who weighed 2,500 or less grams at birth compared with those who weighed 3,600 or more grams (92 per 1,000 births) at birth.

The 1998 RHS used three categories of accommodation, ger (traditional housing of Mongolia), private house and apartment. They vary in terms of bathroom and toilet facilities. In our selected sample, 13.3 percent of private houses and 83.1 percent of apartments have an attached bathroom and 10.5 percent of private houses and 86.1 percent of apartments have an inside toilet. But a ger has no attached bathroom and inside toilet.

Table 3 presents sex differentials in neonatal and infant mortality rates by mother's current place of residence, mother's educational level and kind of accommodation. With some exceptions, mortality among males is generally higher than for females. However, the sex differentials in mortality are generally lower at the higher mortality categories and greater at the lower mortality categories. Thus the sex of a child is strong factor in mortality and one that does not disappear with increasing mother's educational level and living conditions.

Table 4 shows early neonatal, neonatal, infant, child and under-five mortality rates by two categories of residence (urban and rural), regions of residence and four categories of mother's current and previous places of residence. For two categories of residence, urban includes Ulaanbaatar city and aimag center while rural includes soum center and rural area.

Child mortality rates are consistently higher at all ages in rural areas than in urban areas. Mortality rates vary from region to region in Mongolia. The highest mortality was found in the West region at all ages except neonatal while the lowest was found in the South region, followed by the capital city Ulaanbaatar.

Mortality rates are higher for children whose mother's current place of residence is either soum center or a rural area. Similarly, mortality rates are highest for children whose mother's previous place of residence was a rural area except child mortality.

Table 5 presents mortality rates by mother’s and husband’s educational level and husband’s employment. Maternal education has been identified as one of the most important socio-economic determinants of infant and child mortality (Caldwell, 1981 and Dyson, 1981).

Mortality rates generally decrease with increase in both mother's and husband's educational level. Early neonatal mortality is 46 percent lower for children whose mothers have higher education than for children whose mothers have 1-3 years of schooling. Similarly, neonatal, infant and under-five mortality rates are lower by 21.4, 48.4 and 84.9 points, respectively, for children whose mothers have higher education than for children whose mothers have only 1-3 years of schooling.

Early neonatal, neonatal, infant and under-five mortality rates for children who were born to mothers whose husbands have higher education are lower by 10.5, 11.1, 34.7 and 59.6 points, respectively, than for those children who were born to mothers whose husbands have only 1-3 three years of schooling. However, neonatal, infant and under-five mortality rates were higher for husbands with higher education than for those who have professional schooling. This is may be because women with better educated husbands more completely reported infant deaths. It is important to point out that the differences in mortality rates across categories of mother's educational level are greater than for her husband's educational level.

In line with the expectation, mortality rates were higher for children who were born to mothers whose husband’s were unemployed. Neonatal, infant, child and under-five mortality rates are lower by 4.9, 5.3, 9.9 and 14.3 points, respectively, for children who were born to mothers whose husbands were employed at the time of the survey than for those children who were born to mothers whose husbands were unemployed at the time of the survey. However, the differences by husband’s employment appear to be less than differences by husband’s education. Both paternal and maternal education levels appear to be much more influential than, say, the employment of status of the mother (Hobcraft et al., 1982).

Table 6 shows mortality rates by kind of accommodation, use of electricity, bathroom and toilet facilities and fastest way to request medical assistance in an emergency.

As expected, children's mortality rates are consistently higher at all ages for children who live in gers than those who live in houses and apartments. Early neonatal, neonatal, infant, child and under-five mortality rates for children who live in gers are 14.4, 13.9, 26.7, 6.4 and 32.2 points higher, respectively, than for those who live in apartments.

Electricity is an important household characteristic. Mortality rates are lower for children whose households use electricity. Early neonatal, neonatal, infant, child and under-five mortality rates for children whose households use electricity are 7.2, 10.3, 24.8, 5.7 and 29.6 points lower, respectively, than those whose households do not use electricity.

An attached bathroom and/or toilet is an important household hygienic facility. Mortality rates are lower for children who live in households that have attached bathrooms and toilets. These results tend to support to the findings of Hobcraft (1981) and Sastry (1996). Neonatal, infant, child and under-five mortality rates for children who live in households that have an attached bathroom are 0.4, 19.4, 9.3 and 27.8 points lower, respectively, than for those whose households have a separate bathroom. Similarly, neonatal, infant, child and under-five mortality rates for children who live in households that have an attached toilet are 2.2, 17.1, 4.4 and 20.9 points lower, respectively, than those whose households have a separate toilet. The differences are mostly higher for bathroom than for toilet. This might mean that it is more important to have an attached bathroom than to have an attached toilet for lowering infant and child mortality. It is may be because bathroom facility has two underlying factors, hygiene and drinking water.

The fastest way to request medical assistance in an emergency is an important characteristic of health service availability. Table 6 shows that mortality rates are lowest for children whose households request assistance in an emergency by phone. This study found that mortality is higher for children whose households request assistance in an emergency by car/motorcycle and horse/camel/yak. This finding agrees with the notion that mortality is higher in places where health facility is poor and support Dyson's argument that the availability of health services can result in quite sizeable reductions in mortality, but they may have little effect outside their immediate localities.

Table 7 provides mortality rates by whether the mother reads a newspaper, listens to the radio and watches television at least once a week. In our survey, 88.3 percent of urban women reported that they read newspaper at least once a week while 59.7 percent of rural women reported the same. Similarly, 83.9 percent of urban women reported that they listen to the radio at least once a week while 72.7 percent of rural women stated the same. Also 96.0 percent of urban women reported that they watch TV at least once a week while 38.2 percent of rural women reported the same (NSO and UNFPA, 1999). These frequencies show that the prevalence of mass media is higher in urban areas. TV is the most prevalent media in urban areas while radio is the most prevalent media in rural areas.

Newspaper, radio and television are the main types of mass media in Mongolia. Very important information about health, particularly, reproductive health, is transmitted through these types of mass media. Therefore, access to these will have a positive effect on lowering infant and child mortality. According to Table 7, neonatal, infant, child and under-five mortality rates for children whose mothers read a newspaper at least once a week are 4.6, 7.9, 9.8 and 16.9 points lower, respectively, than those who do not read a newspaper at least once a week. Similarly, neonatal, infant, child and under-five mortality rates for children whose mothers listen to the radio at least once a week are 3.4, 15.7, 3.4 and 18.5 points lower, respectively, than those who do not listen to the radio at least once a week. The differences in mortality rates are greater for television than for both radio and newspaper. This might mean that radio and television are better means of broadcasting information about health than are newspapers. Neonatal, infant, child and under-five mortality rates for children whose mothers watch television at least once a week are 10.7, 26.0, 3.1 and 28.3 points lower, respectively, than those who do not watch television at least once a week.

Table 8 shows the neonatal mortality rate by mother's educational level cross-classified by husband's educational level, kind of accommodation and use of electricity.

Although the results are neither uniform nor significant, both mother's and her husband's educational level are associated with neonatal mortality. When controlling for husband's education, neonatal mortality rates are generally lower for women who have 9-10 years of schooling or higher education than for those who have only 4-8 years of schooling. For women who have professional secondary or higher education, husband’s education has little effect on neonatal mortality. Among women with less education, however, neonatal mortality rates are generally lower for those whose husbands have 4-10 years and professional schooling than for those whose husbands have only 1-3 years of schooling. Neonatal mortality rates apparently are higher for women whose husbands have higher education, perhaps because of the small number of cases involved.

Holding mother's educational level at the lowest level, 1-3 years of schooling or at the highest level, neonatal mortality is higher for children who live in apartments than in gers. Conversely, for each type of accommodation, neonatal mortality rates generally decline with increases in mother’s education. This indicates that better living condition does not decrease child mortality as much as mother’s education. This again confirms that mother's educational level is the most important factor in the risk of dying of children. On the other hand, for some educational levels of mother, neonatal mortality is lower for children who live in apartments than who live in gers.

Infant mortality rates apparently are higher for women who have 4-8 and 9-10 years of schooling and whose husbands have higher education, and for women who have 1-3 and 4-8 years of schooling and live in apartments. These findings may be partly because of the small number of cases involved and partly because better educated husband and urban women more completely reported infant deaths.

Neonatal mortality is high for children who live in households which do not use electricity at all levels of mother's education. However, the difference in neonatal mortality by the use of electricity decreases with the increase in mother's educational level. Thus, mother’s education served as a substitute to husband’s education and housing condition and as a complement to electricity use for neonatal mortality.

Table 9 presents infant mortality rates by mother's educational level cross-tabulated by husband's educational level, kind of accommodation and use of electricity.

If one holds mother's educational level constant at the lowest level, 1-3 years of schooling, infant mortality does not decrease with increasing husband's educational level. On the other hand, if one holds constant husband's educational level at the lowest level, 1-3 years of schooling, infant mortality decreases with increasing level of mother's education starting from 4-8 years of schooling. The infant mortality rate is 76.3 points lower for children whose mothers have professional schooling than for those whose mothers have 4-8 years of schooling when one holds husband's educational level constant at the lowest level.

Holding mother's educational level constant at 4-8 years of schooling, infant mortality is higher for children who live in apartments than in gers. On the other hand, with increasing mother's educational level, particularly for 9-10 years and professional schooling, infant mortality is lower for children who live in apartments than those who live in gers.

At all levels of mother's education, infant mortality is lower for children who live in households that use electricity. As was true for neonatal mortality, the difference in infant mortality by the use of electricity decreases with increasing mother's educational level. For infant mortality, mother's education served as a substitute to husband's education and as a complement to housing conditions and electricity use.

CHAPTER 3. LOGISTIC REGRESSION ANALYSIS

This chapter presents the results of the logistic regression models which were run using the Statistical Package for the Social Science (SPSS). This study aims at showing the effect of the bio-demographic and socio-economic variables on risk of dying of children born in the previous ten years, but excluding births that occurred in the past one year, before the survey. Logistic regression models were ran controlling for sex of child, mother's age at birth, birth interval, mother's current place of residence, mother's education, husband's education, husband's employment, use of electricity, fastest way of requesting assistance in an emergency and whether the mother reads a newspaper, listens to the radio and watches television. Earlier it was mentioned that neonatal mortality is more likely to be affected by endogenous factors while infant mortality is more likely to be affected by exogenous factors. Endogenous infant mortality is approximately equivalent to neonatal death (Wrigley, 1977). Therefore, separate models are presented for neonatal and infant mortality.

Table 10 presents the neonatal mortality model built from the above-mentioned variables. In the neonatal mortality model, out of all the variables that were included in the logistic regression, sex of child, birth interval and use of electricity appeared to be the most significant factors in determining the likelihood of dying before reaching the first month of life. According to the neonatal mortality model, female children were 30 percent are less likely to die before reaching first month of life. Children born 18-23, 24-35, 36-47 and 48 or more months after the previous birth were about 52, 60, 65 and 54 percent, respectively, less likely to die before reaching one month of life than those who were born less than 18 months after the previous birth.

The odds of a child dying before reaching one month of age was 1.4 times higher for children whose households do not use electricity compared with those who use electricity.

Table 11 shows the infant mortality model built from the above-mentioned variables. This model indicates that out of all the variables that were included in the logistic regression to build the model, sex of child, birth interval, mother's education, and use of electricity appeared to be the most significant predictors of infant mortality. According to the infant mortality model, female children were 28 percent less likely to die before reaching one year of age.

Children born 18-23, 24-35, 36-47 and 48 or more months after the previous birth were about 58, 57, 69 and 65 percent, respectively, less likely to die before reaching one year of age than those who were born within 18 months of the previous birth. Compared with children whose mothers have 1-3 years of schooling, children with mothers who have 4-8, 9-10 years, professional schooling and higher education were about 22, 34, 40 and 46 percent, respectively, less likely to die before reaching one year of life. The odds of a child dying before reaching one year were about 1.3 times higher for children whose households do not use electricity compared with those who use electricity.

These models suggest that in order to lower infant and child mortality, it is essential to provide greater attention to increase education of lower educated women. Alternatively, the reproductive health program should pay special attention to the need of lower educated women. Moreover, the reproductive health program should continue to emphasize spacing between births through effective use of contraception. Similarly, it is very important for the Mongolian government to take action to provide with electricity those households that do not use electricity in order to decrease neonatal and infant mortality. Thus, according to the findings of this study, 'Death clustering' or high risk families in Mongolia could be the families or households where mother's education is low, children were born within short birth intervals and which do not use electricity.

CHAPTER 4. COMPARISON OF ESTIMATES OF INFANT AND CHILD MORTALITY FROM DIFFERENT DATA SOURCES

This chapter aims to provide some explanations for the difference in estimates derived from the 1998 RHS and vital registration. Vital registration is one of the important sources of information on infant and child mortality. Births and usually to a greater degree, deaths tend to be under-reported. In general, child deaths are probably better registered than those of infants. Within infancy, neonatal deaths are often especially poorly reported.

Similar with other countries' data sources presented by Dyson, the 1998 RHS provides a better estimation for infant and child mortality in Mongolia than vital registration (Table 12). This study suggests several reasons to support this conclusion. First, it could be supported by the argument that the overall quality of survey was excellent (NSO and UNFPA, 1999). The second reason to support this conclusion is an indirect estimation ran by MORTPAK based on children ever born and children ever surviving. According to this estimation, the infant mortality rate stands at 66 deaths per 1,000 births. A third reason is the infant mortality rate derived from indirect estimation from the Children Development Survey conducted in July 2000 by the NSO with United Nations Children's Fund (UNICEF) financial assistance. This survey interviewed 8,257 women aged 15-49. According to the indirect estimation run by QFIVE based on children ever born and children surviving, the IMR is 64 deaths per 1,000 live births. Fourthly, surprisingly, vital registration itself also provides support for this estimate. As we know, mortality rates are normally lower in urban areas at the aggregate level than in rural areas. According to vital registration data, there were 50.1 infant deaths per 1,000 births in Ulaanbaatar in 1997 (NSO, 1998) and, in contrast with expectations, it was higher than for the aimags. Is that really true that Ulaanbaatar has higher infant mortality compared with aimags or rural areas? The 1998 RHS provides a very close estimate of IMR for Ulaanbaatar (51.5 infant deaths per 1,000 births) to IMR for Ulaanbaatar estimated from vital registration but it was lower than for other regions, except the South region. These estimates suggest that vital registration is more complete in Ulaanbaatar city compared with rural areas. Also, it is possible to argue that births tend to be under-reported at least at the same extent as deaths do.

Researchers have provided a number of explanations for the difference between actual and registered infant mortality rates in the Former Soviet Union (FSU) and these could be a subject for further investigation in Mongolia. It can be due to the differences in definitions. WHO uses a broader definition of a live birth than did the FSU. In Mongolia the vital registration was subject to the FSU definition till 1998 while the 1998 RHS used the WHO definition.

The WHO (1977) definition states that an infant who shows any signs of life after birth should be classified as a live birth. Signs of life include a heartbeat, breathing, crying, pulsation of the umbilical cord or voluntary movement. According to the FSU definition, any infant who died within the first seven days of life and who was (a) under 28 weeks of gestation, (b) weighed less than 1,000 grams or (c) was less than 35 centimetres long at birth would never become part of the mortality statistics, but would have been classified as a stillbirth (also termed a late fetal death). Anderson and Silver (1986) have pointed out that the FSU definition of a live birth could lead to underestimation of the IMR and particularly, the congenital and perinatal mortality rates. According to the WHO definition, the perinatal mortality rate is the sum of late fetal deaths and infant deaths before age 7 days divided by the sum of late fetal deaths and live births and multiplied by 1,000.

Velkoff and Miller (1995) argue that misreporting of infant mortality occurs due to misclassification as well as under-registration. Infant deaths were more likely to be intentionally misclassified as a stillbirth/premature birth if any aspect of the definition was in doubt.

Velkoff and Miller (1995) argue that one explanation for misclassfication could be that infant mortality rates were one criterion used to evaluate hospitals and clinics, and in this connection, it was easy not to register a death if it occurred soon after birth and the birth had not yet been registered. Ksenofontova (1990) found that the reported neonatal mortality rates were too low relative to the post-neonatal mortality rates in some FSU countries when compared with other countries. According to her, the low neonatal mortality relative to post neonatal mortality or underestimation of neonatal mortality rates was due to reporting early deaths as stillbirths and to the relatively poor completeness of death registration in some republics. Ksenofontova (1990) also examined the problem of deaths being erroneously assigned from the first to the second year of life in FSU. Velkoff and Miller (1995) also argue that these types of misclassification and underregistration were more likely to occur in less developed republics such as the Central Asian Republics, particularly in rural areas and among infants born at home. Another explanation is that the time limit within which a birth or death must be registered may have contributed to variation in misreporting. They argue that the decline in misreporting, due to improved registration and monitoring, has contributed in the increase in the recorded infant mortality rate, particularly in Muslim republics.

CHAPTER 5. SUMMARY AND CONCLUSION

The Mongolian Reproductive Health Survey of 1998 found that infant mortality had decreased in the five years preceding the survey compared with the previous five-year period. In contrast, early neonatal and neonatal mortality rates, the rates that are more likely to be affected by endogenous factors, increased for the same period. This finding could be spurious, however, if reporting of neonatal deaths for the period 5-9 years prior to the survey was less complete than for that 0-4 years prior to the survey.

The results of life table analysis by selected bio-demographic characteristics are essentially as expected. As elsewhere in the world, except for example, what was found in South Asia (Dyson, 1982), male children are more likely to die than female children in Mongolia.

This study found that children born to very young and very old mothers are more likely to die and these findings are consistent with those of Hobcraft, McDonald and Rutstein (1995). Effective programs to reduce teenage childbearing would lower infant and child mortality.

Mortality is high for children born at higher parities as well as for first-born children. The probability of dying before age five for children born less than two years after a previous birth is more than double that for those children born four or more years after a previous birth (NSO and UNFPA, 1999). This finding is in line with what was found by Hobcraft, Mcdonald and Rutstein (1983).

Mortality rates are higher for children who weighed 2,500 grams or less at birth than those who weighed 3,600 grams or more.

Sex differentials, analysed by some socio-economic variables, in mortality are lower at the higher mortality categories and greater at the lower mortality categories.

This study shows that mortality is higher for children in rural areas than in urban areas. Similarly, mortality is higher for children whose mother's previous place of residence was rural.

The highest child mortality was found in the West region while the lowest was found in the South region, followed by the capital city Ulaanbaatar. The low rate that was found in the South region could be due to the fact that the winter there is a bit milder than in the rest of the country.

Maternal education has been identified as one of the most important socio-economic determinants of infant and child mortality (Caldwell, 1981 and Dyson, 1981). As elsewhere in the world, mortality rates decrease with increase in both mother's and husband's educational level and the differences in rates were greater for mother's educational level than husband's educational level.

The current study found that children of mothers whose husbands were employed at the time of the survey were less likely to die than those whose mother's husbands were unemployed and the difference was greater for older age mortality. However, the differences by husband's employment appear to be less than differences by husband's education. Both paternal and maternal education levels appear to be much more influential than, say, the employment status of the mother (Hobcraft et al., 1982).

As expected, children's mortality rates are consistently higher for children who live in gers than those who live in apartments. Mortality rates are lower for children whose households use electricity. Mortality rates are lower for children who live in households that have attached bathrooms and toilets. These results tend to support to the findings of Hobcraft (1981) and Sastry (1996). The differences are mostly higher for bathroom than for toilet. This might mean that it is more important to have an attached bathroom than to have an attached toilet for lowering infant and child mortality. This study found that child mortality is higher for children whose households request medical assistance in an emergency by car/motorcycle and horse/camel/yak. This finding agrees with the notion that mortality is higher in places where health facilities are poor and support Dyson's argument that the availability of health services can result in quite sizeable reductions in mortality, but they may have little effect outside their immediate localities.

Infant and child mortality rates were lower for children whose mothers read a newspaper, listen to the radio and watch television compared with those children whose mothers do not. The differences in mortality rates were greater for television than for both radio and newspaper. The prevalence of mass media is higher in urban areas. Moreover, television is the most prevalent media in urban areas while radio is the most prevalent media in rural areas.

An increasing level of husband's education is associated with high neonatal mortality for less educated mothers (1-3 years of schooling). Similarly, better condition of housing is associated with high neonatal mortality for less educated mothers. In contrast, neonatal mortality is high for children who live in households which do not use electricity at all levels of mother's education. Thus, mother's education served as a substitute to husband's education and housing conditions, and as a complement to electricity use, for neonatal mortality in Mongolia. For infant mortality, mother's education served as a substitute to husband's education, and as a complement to the housing conditions and electricity use.

According to the neonatal mortality model, out of all the variables that were included in the logistic regression, sex of child, birth interval and use of electricity appeared to be the most significant factors in determining the likelihood of dying before reaching one month of life.

The infant mortality model indicated that out of all the variables that were included in the logistic regression to build the model, sex of child, birth interval, mother's education and use of electricity appeared to be the most significant predictors of infant mortality.

Logistic regression models of neonatal and infant mortality suggest that in order to lower infant and child mortality, it is essential to provide greater attention to increase education of lower educated women. Alternatively, the reproductive health program should target the lower educated women. Moreover, the reproductive health program should continue to emphasize spacing between births through effective use of contraceptive. Similarly, it is very important for the Mongolian government to take action to provide with electricity those households that do not use electricity in order to decrease neonatal and infant mortality. In connection with electricity use, it is important to increase prevalence of television in rural areas, which is now low. Thus, according to the findings of this study, 'Death clustering' or high risk families in Mongolia could be the families or households where mother's education is low, children were born within short birth intervals and which do not use electricity.

Similarly, this study concludes that the 1998 RHS presents very realistic infant and child mortality rates. This is supported by indirect estimations of infant mortality run by MORTPAK and QFIVE, from the 1998 RHS and the 2000 Children Development Survey, respectively; and with vital registration itself. The difference between mortality rates estimated by the 1998 RHS and recorded by vital registration can be explained by a number of factors, such as misclassification, underregistration and misreporting. Also it is possible to argue that births tend to be under-reported at least at the same extent as deaths do.

Finally, this study recommends that further detailed research needs to be conducted based on hospital registration to provide more important explanations for differences in mortality rates from the 1998 RHS and vital registration.

BIBLIOGRAPHY

Anderson, B. A and Silver, B. D. (1986) 'Infant mortality in Soviet Union: Regional differences and measurement issues'. <u>Population and Development Review</u>, 42, 705-738.

Arriaga, E. E. (1979) 'Infant and child mortality in selected Asian countries'. <u>Proceedings of the Meeting on Socioeconomic Determinants and Consequences of Mortality</u>. EI Colegio de Mexico City

Bhuiya, A and Chowdhury, M. (1997) 'The effect of divorce on child survival in a rural area of Bangladesh'. Population Studies, 51, 57-61.

Caldwell, J. C. (1981) 'Maternal education as a factor in child mortality', World Health Forum, 2, 75-78.

Dyson, T. 'Infant and child mortality in developing countries'. Unpublished working paper.

Dyson, T. (1981) 'Infant, child and maternal mortality and associated conditions of health in the Greater Kabul region of Afghanistan'. World Health Statistics, Q34, 14-43.

Dyson, T. (1982), India's regional demography. London

Government of Mongolia. (1996), Population Policy of Mongolia. Ulaanbaatar

Gupta, M. (1990) 'Death clustering, mother's education and the determinants of child mortality in rural Punjab, India'. Population Studies, 44, 489-505

Gupta, M. (1997) 'Socio-economic status and clustering of child deaths in rural Punjab'. Population Studies, 51, 191-202.

Hart, N. (1998) 'Beyond infant mortality: Gender and stillbirth in reproductive mortality before the twentieth century' Population Studies, 52, 215-229

Hobcraft, J. N. (1981) 'Use of special mortality questions in fertility surveys – The WFS experience'. Paper presented to a UN/WHO Working group on data bases for measurement of levels, trends and differentials in mortality, 1981, Bangkok

Hobcraft, J. N., McDonald, J. W. and Rutstein, S. O. (1982) 'Socioeconomic factors in infant and child mortality: A cross-national comparison'. World Fertility Survey. London

Hobcraft, J. N., McDonald, J. W. and Rutstein, S. O. (1983) 'Child spacing effects on infant and child mortality'. Population Index, 49, 585-618

Hobcraft, J. N., McDonald, J. W. and Rutstein. S. O. (1985) 'Demographic determinants of infant and early child mortality: Comparative analysis'. Population Studies, 39, 363-85.

Ksenofontova, N. Iu. (1990) 'An approach to evaluating reliability of infant mortality statistics in the USSR'. Paper presented to the International Symposium on Demographic Processes in the USSR in the 20th century in the Context of the European Experience. 8-12 October 1990, Tblisi

LeGrand, T. and Phillips, J. (1996) 'The effect of fertility reductions on infant and child mortality: Evidence from Matlab in rural Bangladesh'. Population Studies, 50, 51-68

Mosley, W. H. and Chen, L. C. (1984) 'An analytical frame-work for the study of child survival in developing countries'. Population and Development Review, 10 (suppl.), 25-45

Muhuri. P. (1996) 'Estimating seasonality effects on child mortality in Matlab, Bangladesh'. Demography, 33-1, 98-110

NSO and UNFPA. (1999), The Reproductive Health Survey of Mongolia, 1998, Ulaanbaatar

NSO. (1990, 1998 and 2000), Statistical Yearbook 1990, 1998 and 2000. Ulaanbaatar

Panis, C. and Lillard, L. (1995) 'Child mortality in Malaysia: Explaining ethnic differences and the recent decline'. Population Studies, 49, 463-479

United Nations. (1999), Programme of Action of the 1994 International Conference on Population and Development. New York: United Nations Publication

Ronsmans, C. (1995) 'Patterns of clustering of child mortality in a rural area of Senegal'. Population Studies, 49, 443-461

Sastry, N. (1996) 'Community characteristics, individual and household attributes, and child survival in Brazil'. Demography, 33-2, 211-229

Smith, DP. (1980) 'Life table analysis'. World Fertility Technical Bulletins. No.6

Somoza. J. (1976) 'Illustrative Analysis: Infant and Child Mortality in Colombia'. Scientific Reports. London

Trussell, J. and Hammerslough, C. A. (1983) 'Hazard-model analysis of the covariates of infant and child mortality'. Demography, 20-1, 1-26

Velkoff, V and Miller, J. (1995) 'Trends and differentials in infant mortality in the Soviet Union, 1970-90: How much is due to misreporting?'. Population Studies, 49, 241-258

Williams, N and Galley, C. (1995). 'Urban-rural differentials in infant mortality in Victorian England'. Population Studies, 49, 401-420

WHO. (1977), Manual of the International Statistical Classification of Diseases, Injuries and Causes of Death. Ninth edition, Geneva

Wrigley, E.A. (1977) 'Births and baptisms: the use of Anglican baptism registers as a source of information about the number of births in England before the beginning of civil registration'. Population Studies, 31, 281-312

Table 1. Mortality rates for five-year and ten-year periods preceding the survey, Mongolia, 1998

Years preceding the survey	Mortality rate (per thousand)				
	Early neonatal	Neonatal (NN)	Infant ($_1q_0$)	Child ($_4q_1$)	Under-five ($_5q_0$)
0-4[a]	25.7	34.5	65.0	17.2	81.0
5-9[a]	21.0	29.9	72.8	30.9	101.5
0-9	23.3	32.0	68.3	21.9	88.7

[a] Source: NSO and UNFPA, The 1998 RHS, p.71.

Table 2. Mortality rates 1989-1997 by selected bio-demographic characteristics, Mongolia

	Mortality rate (per thousand)				
	Early neonatal	Neonatal (NN)	Infant ($_1q_0$)	Child ($_4q_1$)	Under-five ($_5q_0$)
Sex of Child[a]					
Male	23.6	37.7	80.7	27.1	105.7
Female	18.0	26.3	57.3	22.0	78.1
Mother's Age at Birth χ^2= 2.400, df=5, p<0.1					
15-19	29.5	43.0	82.9	14.3	96.0
20-24	23.1	32.7	72.0	17.3	88.1
25-29	19.6	27.2	62.7	27.0	85.7
30-34	23.1	29.0	65.8	30.5	94.3
35-39	35.1	46.1	69.3	16.0	84.2
Birth Order[a]					
1	22.7	34.1	65.1	17.9	81.9
2-3	21.5	28.4	63.7	23.7	85.9
4-6	29.0	37.3	82.3	32.3	111.9
7+	18.7	29.1	84.3	35.6	116.9
Birth Interval[a]					
< 2 Years	-	47.7	107.0	31.3	134.9
2-3 Years	-	21.9	56.2	29.4	83.9
4 Years or More	-	25.0	46.7	16.2	62.2
Weight at Birth (grams) χ^2= 9.622, df=2, p<0.01					
Less than 2500	55.2	76.8	162.3	41.1	196.7
2600 – 3500	31.5	44.2	111.9	35.6	143.5
3600 and over	24.9	37.4	92.0	41.0	129.2

[a]Source: NSO and UNFPA, The 1998 RHS, p.73.

Table 3. Sex differentials in neonatal and infant mortality rates 1989-1997 by selected socio-economic characteristics (per thousand), Mongolia

		Neonatal (NN)		Infant ($_1q_0$)	
		Male	Female	Male	Female
Mother's current place of residence					
Ulaanbaatar	χ^2=2.121, df=1, p<0.5	37.8	20.8	55.8	43.6
Aimag Center	χ^2=8.976, df=1, p<0.005	30.5	15.3	71.9	43.0
Soum Center	χ^2=14.827, df=1, p<0.0001	45.0	20.0	97.6	53.3
Rural	χ^2=1.727, df=1, p<0.5	36.8	39.6	86.0	73.8
Mother's educational level					
Grade 1-3	χ^2=0.020, df=1, p<1.0	37.6	45.0	93.7	91.6
Grade 4-8	χ^2=8.973, df=1, p<0.005	45.9	28.2	97.5	68.6
Grade 9-10	χ^2=4.062, df=1, p<0.05	31.3	26.0	76.3	58.6
Professional school	χ^2=11.402, df=1, p<0.001	41.6	19.3	71.6	39.4
Higher education	χ^2=0.203, df=1, p<1.0	20.5	25.1	51.0	44.1
Kind of accommodation					
Ger	χ^2=10.938, df=1, p<0.0009	42.4	32.2	89.1	64.8
Private house	χ^2=3.819, df=1, p<0.1	31.7	21.5	70.9	52.4
Apartment	χ^2=7.076, df=1, p<0.01	31.8	15.2	62.7	38.2

Table 4. Mortality rates 1989-1997 by residence and region, Mongolia

	Mortality rate (per thousand)				
	Early neonatal	Neonatal (NN)	Infant ($_1q_0$)	Child ($_4q_1$)	Under-five ($_5q_0$)
Residence[a]					
Urban	18.4	26.6	54.5	21.5	74.8
Rural	26.6	35.9	79.4	27.0	104.3
Region[a]					
Central	22.0	30.4	76.8	26.7	101.5
East	27.4	37.6	76.5	24.7	99.3
West	29.7	37.3	76.8	28.6	103.2
South	16.7	20.1	45.2	14.9	59.4
Ulaanbaatar	17.1	29.6	51.5	19.8	70.3
Mother's current place of residence χ^2 = 19.517, df=3, p<0.0005					
Ulaanbaatar	17.1	29.6	49.9	16.3	65.4
Aimag Center	19.7	23.3	58.4	19.3	76.6
Soum Center	24.5	32.2	74.9	24.6	97.7
Rural	27.9	38.2	80.0	24.8	102.9
Mother's previous place of residence χ^2= 5.496, df=3, p<0.5					
Ulaanbaatar	19.2	22.4	55.4	31.1	84.8
Aimag Center	19.5	30.8	50.9	30.8	80.1
Soum Center	19.6	29.8	66.1	19.4	84.2
Rural	41.8	49.3	90.2	12.1	109.4

[a]Source: NSO and UNFPA, The 1998 RHS, p.72.

Table 5. Mortality rates 1989-1997 by mother's and husband's educational level and husband's employment, Mongolia

	Mortality rate (Per thousand)				
	Early neonatal	Neonatal (NN)	Infant ($_1q_0$)	Child ($_4q_1$)	Under-five ($_5q_0$)
Mother's education[a]					
Grade 1-3	27.6	44.2	99.7	14.5	141.8
Grade 4-8	28.7	37.3	82.5	17.9	113.4
Grade 9-10	20.2	28.8	68.6	8.2	84.7
Professional school	23.1	30.7	60.6	7.3	67.5
Higher education	14.8	22.8	51.3	6.0	56.9
Husband's education χ^2 = 30.106, df=4, p<0.00005					
Grade 1-3	33.3	45.9	98.3	41.0	135.3
Grade 4-8	23.9	30.4	71.1	26.4	95.6
Grade 9-10	18.6	27.7	59.7	19.7	78.2
Professional school	23.2	30.6	59.0	13.0	71.2
Higher education	22.8	34.8	63.6	12.9	75.7
Husband's employment χ^2= 1.532, df=4, p<0.5					
Employed	-	32.5	69.1	20.6	88.3
Unemployed	-	37.4	74.4	30.5	102.6

[a]Source: NSO and UNFPA, The 1998 RHS, p.72.

Table 6. Mortality rates 1989-1997 by kind of accommodation, use of electricity, bathroom and toilet facilities and way to request medical assistance in an emergency, Mongolia

	Mortality rate (per thousand)				
	Early neonatal	Neonatal (NN)	Infant ($_1q_0$)	Child ($_4q_1$)	Under-five ($_5q_0$)
Kind of accommodation χ^2 = 15.997, df=2, p<0.0005					
Ger	28.9	37.4	77.2	23.9	99.3
Private house	17.6	26.8	62.0	20.8	81.5
Apartment	14.5	23.5	50.5	17.5	67.1
Use of electricity χ^2= 19.614, df=1, p<0.00005					
No	27.7	38.4	83.8	25.5	107.2
Yes	20.5	28.1	59.0	19.8	77.6
Bathroom χ^2= 7.309, df=1, p<0.01					
Attached	-	25.8	45.9	13.9	59.2
Separate	-	25.4	65.3	23.2	87.0
Toilet χ^2 = 4.233, df=1, p<0.05					
Attached	-	26.9	47.2	16.9	63.3
Separate	-	24.7	64.3	21.3	84.2
Fastest way to request medical assistance in an emergency χ^2= 18.853, df=3, p<0.0005					
Phone	19.1	28.1	53.6	18.5	71.1
Car/motorcycle	36.8	48.2	82.2	16.0	96.9
Horse/camel/yak	26.0	35.9	82.9	26.9	107.6
Walking	22.1	28.7	69.0	25.2	92.5

Table 7. Mortality rates 1989-1997 by frequency of reading newspaper, listening radio and watching television, Mongolia

	Mortality rate (Per thousand)			
	Neonatal (NN)	Infant ($_1q_0$)	Child ($_4q_1$)	Under-five ($_5q_0$)
Read newspaper at least once a week χ^2 = 4.172, df=1, $p<0.05$				
Yes	30.0	65.1	18.6	82.5
No	34.6	73.0	28.4	99.4
Listen to the radio at least once a week χ^2= 6.072, df=1, $p<0.05$				
Yes	31.1	64.2	21.1	83.9
No	34.5	79.9	24.5	102.4
Watch TV at least once a week χ^2= 18.953, df=1, $p<0.00005$				
Yes	27.7	57.9	20.7	77.4
No	38.4	83.9	23.8	105.7

Table 8. Neonatal mortality rate 1989-1997 by mother's educational level and selected socio-economic characteristics (per thousand), Mongolia

		Mother's educational level				
		Grade 1-3	Grade 4-8	Grade 9-10	Profes-sional school	Higher educa-tion
Husband's educational level						
Grade 1-3	χ^2=3.788, df=4, $p<0.5$	39.2	58.9	54.4	16.7	-
Grade 4-8	χ^2=6.493, df=4, $p<0.5$	31.4	37.6	24.8	26.0	13.5
Grade 9-10	χ^2=7.217, df=4, $p<0.5$	47.6	26.3	27.0	30.0	12.0
Professional school	χ^2=5.759, df=4, $p<0.5$	12.0	27.0	25.5	32.3	18.8
Higher education	χ^2=7.376, df=4, $p<0.5$	-	35.7	36.8	40.0	31.6
Kind of accommodation						
Ger	χ^2=11.065, df=4, $p<0.05$	39.5	39.0	37.0	37.1	15.4
Private house	χ^2=15.109, df=4, $p<0.005$	49.1	32.5	18.3	27.1	27.0
Apartment	χ^2=9.274, df=4, $p<0.1$	47.6	33.9	21.3	22.2	23.3
Use of Electricity						
Yes	χ^2=15.109, df=4, $p<0.005$	18.8	33.6	26.5	30.5	21.9
No	χ^2=9.274, df=4, $p<0.1$	49.1	39.9	33.2	31.6	37.0

Table 9. Infant mortality rate 1989-1997 by mother's educational level and selected socio-economic characteristics (per thousand), Mongolia

		Mother's educational level				
		Grade 1-3	Grade 4-8	Grade 9-10	Profes-sional school	Higher educa-tion
Husband's educational level						
Grade 1-3	χ^2=3.788, df=4, p<0.5	100.4	118.7	104.0	42.4	-
Grade 4-8	χ^2=6.493, df=4, p<0.5	72.7	77.9	77.3	50.7	54.2
Grade 9-10	χ^2=7.217, df=4, p<0.5	153.4	74.4	58.4	57.1	31.8
Professional school	χ^2=5.759, df=4, p<0.5	145.6	68.7	56.4	56.3	43.8
Higher education	χ^2=7.376, df=4, p<0.5	-	145.7	67.9	68.0	55.0
Kind of accommodation						
Ger	χ^2=11.065, df=4, p<0.05	93.6	81.8	79.4	59.0	72.8
Private house	χ^2=15.109, df=4, p<0.005	86.7	82.3	58.8	59.1	37.1
Apartment	χ^2=9.274, df=4, p<0.1	100.5	106.1	48.5	43.0	42.5
Use of electricity						
Yes	χ^2=13.790, df=4, p<0.01	64.8	76.0	63.3	51.1	45.7
No	χ^2=9.868, df=4, p<0.05	102.7	88.7	76.2	69.1	75.2

Table 10. Logistic regression of neonatal mortality by selected variables for all births 1989-1997, Mongolia

		Neonatal	
Variable	Category	Odds ratio*	Variable's significance level, one tailed test
Sex of child	Male	1.000	0.005
	Female	0.686	
Birth interval	<18 Months	1.000	0.005
	18-23 Months	0.485	
	24-35 Months	0.403	
	36-47 Months	0.355	
	48 or More Months	0.461	
Electricity	Yes	1.000	0.05
	No	1.400	

*Odds ratio 1.00 = reference category

Table 11. Logistic regression of infant mortality by selected variables for all births 1989-1997, Mongolia

Variable	Category	Infant	
		Odds ratio*	Variable's significance level, one tailed test
Sex of child	Male	1.000	0.0005
	Female	0.719	
Birth interval	<18 months	1.000	0.00005
	18-23 months	0.421	
	24-35 months	0.431	
	36-47 months	0.309	
	48 or more months	0.348	
Mother's education	Grade 1-3	1.000	0.005
	Grade 4-8	0.778	
	Grade 9-10	0.656	
	Professional school	0.605	
	Higher education	0.545	
Electricity	Yes	1.000	0.05
	No	1.262	

*Odds ratio 1.00 = reference category

Table 12 Infant mortality rates from vital registration and survey

Country	Vital registration		World fertility survey	
	IMR	Date	IMR	Date
Costa Rica	22.3	1978	53.3	1976
Guyana	50.5	1972	57.6	1975
Trinidad and Tobago	24.4	1978	42.0	1978
Jamaica	16.2	1978	43.0	1975-1976
Mongolia	**39.6**	**1997**	**65.0**[a]	**1994-8**

Source: Dyson, T. *Infant and Child Mortality in Developing Countries,* Table II.
[a]Source: NSO and UNFPA, The 1998 RHS, p.71.