FACTORS AFFECTING CHILD MORTALITY IN MONGOLIA

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Abstract
This study aimed to identify the factors affecting child mortality in Mongolia using the secondary data RHS 2009 by the National Statistical Office of Mongolia. From the data, 3,924 women who gave births five years preceding the survey were selected for the study. Univariate, bivariate, and multivariate analysis were employed. The results show that children ever breastfed were 96% less likely than the one never breastfed, children whose mothers aged 30-49 years old were 81% less likely than the children whose mothers aged less than 20 years old, children born more than 2,500 gm were 71% less likely than those born less than 2,500 gm, and girls were 48% less likely to experience death than boys were respectively. Thus, it is recommended that Government to strengthen the family planning programs to prevent teenage pregnancy and low birth weight, and should carry out more actions to raise awareness of benefits of breastfeeding.

KEY WORDS: Under five child mortality /RHS/ mongolia

INTRODUCTION

First five years of human life is vulnerable and determining period of one's life to survive. UN reports that, globally, 8.8 million children a year, or 22,000 a day, die before they reach five years old, and pneumonia, diarrhea, and under-nutrition are the main three factors affecting child deaths which can be prevented. Therefore, United Nations set the Millennium Development Goal 4 (MDG 4) to reduce the under-five mortality rate (U5MR) by two-thirds between 1990 and 2015.

Child mortality rate has been substantially decreasing in the past two decades in Mongolia. According to RHS 2008, U5MR was 24.9 per 1,000 live births. The Government of Mongolia has set a goal of reducing U5MR to 21 per 1,000 live births by 2015. Despite the progress toward reducing child mortality, infant mortality rate still remains with high age-specific death rates and a high IMR (22 per 1,000) at the level of other developing countries (RHS, 2008).

Few theories related with child mortality were developed especially in the context of developing countries. Frameworks of Mosley & Chen and UNICEF framework suggest that maternal, environmental, nutritious, external and personal factors can have impact on child mortality. It is almost common knowledge that children born to young or older mothers have more chance of child mortality than the other age groups (Bongaarts, 1987; Davis, 1988; Sullivian et al, 1994). Moreover, mother's education has inverse relationship with the state of child survival; the lower the mother's education level is, the higher the risk of child mortality is (Haines, 1978; Caldwell, 1979; Cochrane, 1980). Income has direct impact on mother and child health, so the higher the income per capita, the better the nutrition of food, hygienic situation, and accessibility to health services which all have impact on child health (Girma & Genebo, 2002; Kabubo et al., 2006; Mahgoub et al., 2006). Due to unequal distribution and shortage of health facilities and resources, and lower educated inhabitants in rural areas, child mortality is higher there than it is in urban areas (Kabir et al, 1986; MoH 2005 and NCHD 2005a; Hill, Dodd et a. 2006).

It is a consistent finding among the field of health and demographic studies that low birth weight (LBW) is a major cause of child mortality (Institute of Medicine, 1985; Cramer, 1987; Kiely & Susser, 1992; McCormick, 1985; Wilcox & Skjaerven, 1992). Similarly, child's gender is determining factor for child mortality; female children are biologically

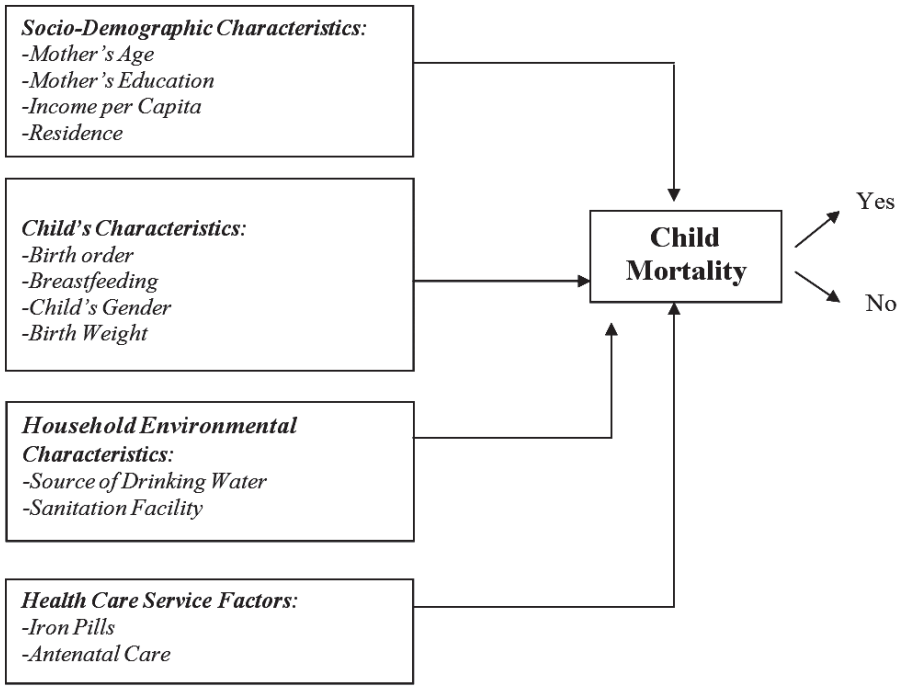
stronger than male children, so they tend to survive better than boys. There is a tendency that a child born in the highest or lowest birth order is more at risk of death (Ahmed, 1986; Bongaarts, 1987). Another significant factor for child survival is breastfeeding, because breast milk has the healthiest form of nutrition for children, and can prevent child mortality (Butz et al, 1982; Edmond, 2006).

One of the leading factors to child mortality is diarrhea which is caused by inadequate quality and quantity of water and sanitation (WHO, 2011). Safe drinking and non-contaminated water is crucial to child survival because that prevents infectious diseases and diarrhea among children. The number of people who share toilet facilities, and, ways of disposing children's feces all matter in the fact of child mortality. As for health care services, children are recommended to do at least four antenatal care visits during their pregnancy because that can contribute to child survival, but also on the later outcome of child's health (Goldenberg et al., 1992; Friscella 1995). Interestingly, the fact that daily iron pill intake during and after pregnancy is crucial for avoiding anemia which often results in low birth weight leading to child mortality.

CONCEPTUAL FRAMEWORK

Based on the reviewed theories and studies in the past, the following conceptual framework has been developed for further analysis.

Figure 1: Conceptual framework of factors affecting child mortality



DATA SOURCE AND UNIT OF ANALYSIS

This study used a secondary data of 'Reproductive Health Survey 2008 (RHS)' by National Statistical Office of Mongolia. In the RHS, 9,402 women of 15-49 years old and 3,362 husbands were interviewed. Under this study, 3,924 of the total women respondents were selected who gave birth within last five years before the survey took place. There were 51 cases of under-five child mortality among the selected women for the study.

METHODOLOGY OF ANALYSIS

Three stages of data analysis were employed. Firstly, bivariate analysis was carried out to explore relationships between socio-demographic, child, household environmental and health care service and

child mortality using crosstabulation with chi-square statistics. Multivariate analysis was employed using binary logistic regression to determine whether independent variables in the model were statistically significant to predict the child mortality. One after another model, groups of independent variables were added into the model to produce the best model. After running the all models, the model 3 had the best goodness of fit, in terms of its increasing values for both Pseudo R2 and Pearson Chi-square. Finally, adjusted probability analysis was done for those independent variables that had statistically significant impacts on child mortality from logistic regression estimates, adjusted for covariates.

Model 1 : $\Pr(Y_j \neq 0 \mid x_j) = \exp(\alpha_j + \beta_{1j} res + \beta_{2j} momage + \beta_{3j} momedu + \beta_{4j} incom)$

$$1+[\exp(\alpha_j + \beta_{1j} res + \beta_{2j} momage + \beta_{3j} momedu + \beta_{4j} incom)]$$

Model 2 : $\Pr(Y_j \neq 0 \mid x_j) = \exp(\alpha_j+\beta_{1j} res+\beta_{2j} momage+\beta_{3j} momedu+\beta_{4j} incom+\beta_{5j} everbf+$

$$\beta_{6j} order+\beta_{7j} infgen+\beta_{8j} childweig+\beta_{9j} wat+\beta_{10j} san+\beta_{11j} ironpil+\beta_{12j} anc)$$

$$1+[\exp(\alpha_j+\beta_{1j} res+\beta_{2j} momage+\beta_{3j} momedu+\beta_{4j} incom+\beta_{5j} everbf+$$

$$\beta_{6j} order+\beta_{7j} chgen+\beta_{8j} chweig+\beta_{9j} wat+\beta_{10j} san+\beta_{11j} ironpil+\beta_{12j} anc)]$$

When: Y – probability of child mortality

j – die, or, survive when Y – probability of child mortality

α_j – constants, β_{1j}, β_{2j}, β_{3j}, β_{4j}, β_{5j}, β_{6j}, β_{7j}, β_{8j}, β_{9j}, β_{10j}, β_{11j}, β_{12j} – regression coefficients

res – place of residence

momage – mother's age

momedu – mother's education

incom – monthly income per person

everbf – ever breastfed

order – birth order

chgen – child's gender

chweig – child weight at birth

wat – source of drinking water

san – sanitation facility

STATA 10.0 and SPSS 11.5 statistical software packages were employed to analyze the data.

RESULTS AND FINDINGS

Bivariate analysis

Bivariate analysis was done to explore relationships between independent variables and child mortality. From *Table 1*, it can be seen that the mother's age had statistically significant relationship with child mortality ($p \leq 0.05$). Mothers whose age were less than 20 tended to experience child mortality more than two times higher than the mothers whose age were 20-29, and more than 4 times than the mothers whose age were 30 years old and more.

Table 1: Crosstabulation between child mortality and selected characteristics

Characteristics	Child Mortality		Total		Chi-square
	No	Yes	%	N	
Place of residence					4.04
Ulaanbaatar	98.93	1.07	100.00	1,309	
East	99.14	0.86	100.00	347	
West	98.05	1.95	100.00	870	
South	98.71	1.29	100.00	233	
Central	98.80	1.20	100.00	1,165	
Mother's age					
<20 years	96.48	3.52	100.00	142	*10.66
20-29 years	98.38	1.62	100.00	1,909	
30+ years	99.20	0.80	100.00	1,873	
Mother's education					
Incomplete secondary	98.51	1.49	100.00	1,143	0.83
Complete secondary	98.64	1.36	100.00	1,401	
Tertiary	98.91	1.09	100.00	1,380	
Monthly income per person (₮)					
<102,535	98.51	1.49	100.00	3,017	3.74
≥102,535	99.34	0.66	100.00	907	
Ever breastfed					
No	81.48	18.52	100.00	108	***256.68
Yes	99.19	0.81	100.00	3,816	
Birth order					
1 & 4+	98.29	1.71	100.00	1,875	*4.63
2 - 3	99.07	0.93	100.00	2,049	
Child's gender					
Male	98.34	1.66	100.00	2,045	*4.28
Female	99.10	0.90	100.00	1,879	
Child's weight					
<2,500 gm	95.03	4.97	100.00	181	***19.95
≥2,500 gm	98.88	1.12	100.00	3,743	
Source of drinking water					
Central/local piped	99.23	0.77	100.00	780	**11.04
Well	98.88	1.12	100.00	2,493	
Spring/mineral/rain/snow/river	97.39	2.61	100.00	651	
Sanitation facility					
Non-standard	98.60	1.40	100.00	2,991	1.07
Standard	99.04	0.96	100.00	933	
Iron pill intake					
<90 pills	98.66	1.34	100.00	3,058	0.18
≥ 90 pills	98.85	1.15	100.00	866	
ANC visit					
<4 visits	97.18	2.82	100.00	319	*6.26
≥4 visits	98.83	1.17	100.00	3,605	
Total				**3,924**	

**** p≤0.001* ***p≤0.01* **p≤0.05*

Child ever breastfed had the strongest statistically significant relationship with child survival. There was only 3% of children who never breastfed, but 18% of the total children who never breastfed experienced child mortality (p≤0.001).

Birth order of the child had statistically significant relationship with child mortality (p≤0.05). Children born in the order one or four and higher experienced death by 0.78% more than children born in the order two or three.

Another factor that had statistically significant relationship with child mortality was child's gender (p≤0.05). Male children died more than female children with 0.76% higher.

Child's weight had quite strong statistically significant relationship with child mortality (p≤0.001). Children who weighed less than 2,500 gm at birth tended to die with 3.85% more than children who weighed more than 2,500 gm.

Another factor that had quite strong statistically significant relationship with child mortality was source of drinking water (p≤0.01). Households who got their water from central or local pipe had child mortality with 0.35% less than the household who got water from well. However, the percentage of experiencing child mortality among households who got water from central or local pipe was 1.84% less than that of the household who got water from spring/mineral/rain/snow/river.

Antenatal care had statistically significant relationship with child mortality (p≤0.05). Mothers who had less than four antenatal care visits tended to experience child mortality with 1.65% more than that of those who had more than four antenatal care visits.

Multivariate analysis

For the first model (*Table 2*), socio-demographic variables were put in the model, and binary logistic regression was run to examine the odds of having child mortality by independent variables. Interestingly, place of residence as regions had no statistically significant effect on child mortality regardless of socio-economic disparities and shortage of health care facilities in rural areas. In Mongolia, all regions except for Ulaanbaatar the capital city are considered as rural areas. However, mothers lived in Eastern region were more likely to experience child mortality 15% more than that of the mothers lived in Ulaanbaatar the capital city. The odds ratio of having child mortality in Western region was 1.78 times more, whilst the odds of child mortality in Southern and Central regions were 1.1 and 1.0 times more than that of the mothers in Ulaanbaatar. As for ages, mothers aged 30 years old or more were 79% less likely to experience child mortality than those who aged less than 20 years old at p≤0.01 level. Mothers who aged between 20 and 29 had no statistically significant impact on child mortality; but, the odds of experiencing child mortality for this age group of mothers comparing to the age group of less than 20 years old were 55% lower. Neither monthly income per person nor mother's education had a statistically significant relationship with child mortality. However, when looked at the odds ratio of monthly income per person, the odds of having child mortality was 52% lower for those who had more than 102,535 ₮ month than those who had less than 102,535 ₮. As for child mortality by mother's education, those who had complete secondary and tertiary education experienced child mortality 1.1 times lower than those who had incomplete secondary education did.

For the second model, all other independent variables were added into the model. This time Pseudo R^2 increased from 0.03 in the previous model to 0.21, as well as LR chi-square increased dramatically from 16.71 in the first model to 115.25 in the second model. The result of odds ratio logistic regression was that a child whose mother's age was 30 years old or more was 81% less likely to experience child mortality than the child whose mother's age was less than 20 years old at p≤0.01 level. None of place of residence as regions, monthly income per person and mother's education had a

statistically significant impact on child mortality. However, in the model two, the size of the odds of mothers experiencing child mortality in Western province decreased by two times from that of in the previous model. Breastfeeding had the most statistically significant impact on child survival. Odds of child mortality for those who ever breastfed were 96% lower than that of those who never breastfed. Birth order did not statistically significantly associate with child mortality. Birth order of the child did not have statistically significant impact on child mortality. Compared to those children who weighed less than 2,500 gm, odds of not dying for those who weighed more than 2,500 gm were 71% lower. Gender of child was statistically significant to child mortality; a female child was 48% less likely to die than a male child.

Neither source of drinking water nor sanitation facility had a statistically significant relationship with child mortality. Compared to those who got their water from central and local pipe, those who got from well had odds of having child mortality were 1.47 times higher, while those whose drinking water source from spring/mineral/rain/snow/river experienced child mortality 3.35 times higher than the former. The odds of child mortality for a mother without a standard sanitation facility were about 1.2 times higher than that of a mother with standard sanitation. Health care service mothers received during their pregnancy did no have statistically significant impact on child mortality. However, the odds of child mortality for those mothers who had more than four antenatal care visits were 36% lower than for those mothers who had less than four antenatal care visits. Mothers who took more than 90 iron pills a day were 32% less likely to experience child mortality than those who took less than 90 iron pills a day.

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Adjusted Probability Analysis

Adjusted probability analysis was done for those independent variables that had statistically significant impacts on child mortality from logistic regression estimates, adjusted for covariates.

A child never had breastfeeding is likely to experience child mortality with 18% of probability. A child ever had breastfeeding is likely to experience child mortality with 1% of probability. Difference between them is 17 points (Table 3).

Table 2: Odds ratios and regression coefficients for child mortality by selected characteristics

Characteristics	Model 1		Model 2	
	OR	B	OR	B
Place of residence				
Ulaanbaatar (ref)				
East	0.85	-0.15	0.79	-0.23
West	1.78	0.58	0.94	-0.05
South	1.10	0.09	1.43	0.35
Central	1.04	0.03	0.81	-0.20
Mother's age <20 years (ref) 20-29 years 30+ years	0.45 **0.21	-0.79 1.53	0.46 **0.19	-0.77 -1.61
Mother's education Incomplete secondary (ref) Complete secondary Tertiary	1.08 1.11	0.07 0.11	1.19 1.16	0.17 0.14
Monthly income per person (₮) <102,535 (ref) ≥102,535	0.48	-0.72	0.65	-0.42
Ever breastfed No (ref) Yes			***0.04	-3.22
Birth order 1 & 4+ (ref) 2 - 3			0.74	-0.30
Child's gender Male (ref) Female			*0.52	-0.65
Child's weight <2,500 gm (ref) ≥2,500 gm			**0.29	-1.22
Source of drinking water Central/local piped (ref) Well Spring/mineral/rain/snow/river			1.47 3.35	0.39 1.12
Sanitation facility Non-standard (ref) Standard			1.18	0.18
Iron pill intake <90 pills (ref) ≥ 90 pills			0.64	-0.38
ANC visit (ref) <4 visits ≥4 visits			100.00	-0.45
LR chi-square		*16.71		***115.25
Pseudo R^2		0.03		0.21

*** p≤0.001 **p≤0.01 *p≤0.05

Table 3: Adjusted probability of child mortality by ever breastfed

Ever breastfed	N	Adjprop	SE
No	108	0.18	0.25
Yes	3,816	0.01	0.18
LR chi^2 = 80.67 p≤0.001			

Table 4 shows that a child born less than 2,500 gm is likely to experience child mortality with 5% of probability. A child born more than 2,500 gm is likely to experience child mortality with 1% of probability. Difference between them is 4 points.

Table 4: Adjusted probability of child mortality by child weight

Child weight	N	Adjprop	SE
<2,500 gm	181	0.05	0.34
≥2,500 gm	3,743	0.01	0.15
LR chi^2 = 12.07 p≤0.001			

According to *Table 5,* a male child is likely to experience child mortality with 2% of probability. A female child is likely to experience child mortality with 1% of probability. Difference between them is one percent

Table 5: Adjusted probability of child mortality by child's gender

Child gender	N	Adjprop	SE
Male	2,045	0.02	0.17
Female	1,879	0.01	0.24
LR chi2 = 4.49 p≤0.05			

Table 6 displays that a child whose mother aged less than 20 years old is likely to experience child mortality with 3% of probability. A child whose mother aged between 20-29 years old is likely to experience child mortality with 2% of probability. A child whose mother aged between 30-49 years old is likely to experience child mortality with 1% of probability. Difference between a child whose mother aged less than 20 years old and a child whose mother aged between 20-29 years old is 1 point. Similarly, difference between a child whose mother aged between 20-29 years old and a child whose mother aged between 30-49 years old is 1 point. However, a difference between a child whose mother aged less than 20 years old a child whose mother aged between 30-49 years old is 2 points.

***Table 6:* Adjusted probability of child mortality by mother's age**

Mother's age	N	Adjprop	SE
Less than 20	142	0.03	0.45
20-29	1,909	0.02	0.18
30-49	1,873	0.01	0.25
LR chi2 = 9.39 p≤0.001			

DISCUSSION

There is a big difference in terms of socio-economic disparity and availability of health facility between Ulaanbaatar the capital city and other regions that are considered as rural areas (MoH, 2005; Hill, Dodd et al., 2006). Ironically, place of residence had neither statistically significant relationship with nor impact on child mortality. It was found that cases of child mortality happened to the mothers whose age were less than 20 years old; and this finding was consistent with experts' observation about J shape relationship between child mortality and mother's age (Bongaarts, 1987; Davis, 1988; Sullivian et al, 1994). Only a quarter of the mothers had monthly income per capita more than 102,535 ₮; however, income did not have any significant impact on child mortality which was different than the views about the fact that income has direct impact on child mortality (Kabubo et al., 2006; Mahgoub et al., 2006). Even though there was no statistically significant impact of mother's education on child mortality, the inverse relationship between mother's education and child mortality was observed in the result which was common finding the experts (Caldwell, 1979; Cochrane, 1980). Birth order 1 & 4+ had significant relationship with child mortality which was supported by other studies (Ahmed, 1986; Bongaarts, 1987). However, later on when the variable put in the model, birth order turned out not to have statistically significant impact on child mortality. Similarly source of drinking water had significant relationship with child mortality, especially those household

whose source of drinking water was from mineral/spring/river/snow/rain experienced more child mortality because this type of water is not from protected areas, thus might cause infection and diarrhea. The researcher expected sanitation facility would show some significant relationship with child mortality because non-standard sanitation facility may cause infectious disease and diarrhea as well. Finding from antenatal care conformed with other studies (Goldenberg et al., 1992; Friscella 1995) showing statistically significant relationship with child mortality; however, there was no statistical impact of ANC on child mortality from logistic regression in this study.

CONCLUSION

In this study, factors affecting child mortality were examined from total of 3,924 women. As a result of binary logistic regression, the factor of ever breastfed had the strongest relationship with and impact on child mortality. There was only 3% of children who never breastfed, but 18% of the total children never breastfed experienced child mortality. Furthermore, those who never breastfed were 96% more likely to die than those who ever breastfed were. Another determining factor that had impact on child mortality was mother's age. Those who were less than 20 years old experienced more child mortality than the other age cohorts. The factor of child's gender had impact on child mortality. Male children experienced more mortality than female children because girls are biologically stronger than boys. One of the strongest factors that affected child mortality was child weight at birth; i.e., children who weighed less than 2,500 gm at birth tended to die more than those weighed more than 2,500 gm (McCormick, 1985; Kiely & Susser, 1992).

The main limitations were, firstly, very little number of child mortality, secondly, no break down of categories on source of drinking water which could have statistically significant impact on child mortality.

RECOMMENDATION

The fact of whether a child ever breastfed or not had the highest impact on child mortality. Therefore, awareness raising activities and promotions about benefits and importance of breastfeeding should be carried out for pregnant women through family clinic doctors during antenatal care visits. Policy makers, government and non-government organizations should pay more attention to strengthen the family planning programs to delay childbearing during very young ages which often results in low birth weight. Future researchers should aim to collect birth history of women in full, not as truncated, so that one may carry out comprehensive analysis of factors affecting child mortality, and produce effective and targeted recommendations to the policy makers.

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