ABHINAV
International Monthly Refereed Journal of Research In Management & Technology
ISSN – 2320-0073 Volume II, August'13

PATTERN AND DIFFERENTIALS OF MORBIDITY AMONG UNDER-FIVE CHILDREN IN BANGLADESH

Md. Mortuza Ahmmed

Lecturer, International University of Business Agriculture and Technology (IUBAT), Dhaka, Bangladesh
Email: mortuza@iubat.edu

ABSTRACT

The study of infant and child mortality in developing countries is an important issue in public health programs. With the increasing emphasis on planning programs in recent years, it becomes increasingly important to determine the general context of infant and child morbidity and mortality levels and policy implications. This study analyzes pattern and determinants of morbidity and mortality of under-five children in Bangladesh. The data for the study comes from the 2007 Bangladesh Demographic and Health Survey (BDHS).

Keywords: Child morbidity, Child mortality, ARI (acute respiratory infection), Under-five mortality rate.

INTRODUCTION

The growing population in the developing world is an increasing challenge for local health authorities. Now a days infant and child morbidity and mortality have become a burning issue of a day. Morbidity and Mortality studies have received increased attention of recent years. Infant and child morbidity and mortality in Bangladesh have long been a topic of interest to population researchers because of its direct relationship with the acceptance of modern contraception. Mortality is one of the three major factors that contribute to population growth (the other two being fertility and migration). In addition to its direct and indirect effect on fertility and thus on various aspects of social and economic planning of a nation, demographers are concerned recently about morbidity and mortality trends. The examination and identification of reliable estimates of levels and trends of morbidity and mortality are gaining increased interest. As about 50 percent of the total number of death in many countries experienced with mortality under five, so mortality studies focuses more on infant and child mortality. There is no doubt that infant and child mortality have been considered as important indicator for describing the mortality situation, health formation and indeed, the overall socio-economic condition of a country. There ids only 75 to 80 percent children in developing countries reach their fifty birthday while over 97 percent of all in developed countries survive through age five. Since these deaths are preventable with current medical technology, the united nation has set a target of 70 deaths under age five per 1000 live births to be achieved by all nations by the year 2000. Infant and child morbidity and mortality has for a long time been regarded as a true reflection of a country's socio-economic and health conditions. The rate of loss in the first year of life attracted particular attention because:

1. Mortality is relatively high, the probability of dying in the first year of life after exceeding the values observed in the following fifty to sixty years of life.
2. It has a considerable impact on the average expectation of life and the rate of population growth.
3. It has disproportionate share in total mortality.
4. It is sensitive to environmental and sanitary condition.

ARI (acute respiratory infection) and diarrhea are major morbidity among under-five children in Bangladesh. For ARI morbidity; age of child ,sex of child, wealth index, division, mothers education, religion, sources of drinking water, vitamin-A coverage and fever may have significant effect. In case of diarrhea; age of child, birth interval, sources of drinking water, household sanitation and fever may have significant effect.

OBJECTIVES OF THE STUDY

- To analyze the patterns and determinants of morbidity among under- five children
- To analyze treatment seeking practices among under- five children.
- To analyze the levels, trends and determinants of mortality among under- five children.

DATA AND METHODOLOGY

The data come from the 2007 Bangladesh Demographic and Health Survey (BDHS). The household questionnaire elicited information on the age, sex, marital status, and education etc. of each member. The main purpose of the household questionnaire was to identify women and men who were eligible for individual interview. In addition, information was collected about the dwelling itself such as the source of drinking water, type of toilet facilities etc. the women's questionnaire was used to collect information from ever- married women age10-49. These women were asked questions on the topics like:

- Background characteristics (age, education, religion etc)
- Reproductive history
- Breast feeding & weaning practices
- Vaccinations and health of children under age five
- Husband's background and respondents work status
- Causes of death of children under-five years of age

In this study acute respiratory infection (ARI) and diarrhea are considered as dependent variables. Acute respiratory infection was defined as one or more of the following signs, symptoms, or self reported syndromes for upper respiratory infection (cough, runny/stuffy nose, sore throat/throat infection) or for lower respiratory infection (rapid / difficult breathing, chest indrawn, bronchitis or bronchopneumonia). The common symptom of acute respiratory infection (ARI) include cough and cough with difficult or rapid breathing. According to WHO guidelines, ARI shows the symptoms of inability to suck or drink presence of first or difficult breathing or chest in drawing with cough and cold. However, fast or difficult breathing isn't always to observe. Febrile illness with troublesome cough arouses suspicion about ARI in a child and the degree of severity can be discriminated through observation of few cardinal signs; inability to drink indicates severe infection; respiratory rate over 50 per minute indicate moderate disease.

According to the guidelines of the United Nations Children Emergency Fund (UNICEF), "the under-five mortality rate is the probability of dying between birth and exactly five years of age per 1000 live births". According to the definition of the World Health Organization (WHO) report 2006, "the under-five mortality rate is the probability of a child born in a specific year or period dying before reaching the age of five, if subject to age- specific mortality rates of that period".

The study deals with a large number of independent variables and examines their relationship with morbidity status of under- five children. The independent variables are categorized as:

Demographic Characteristics

Age of child (months), Sex of child, Mother's age at first birth, Mother's parity, Duration of breast feeding, Sex of household head, Birth interval etc.

Socioeconomic Characteristics

Wealth index, Place of residence, Division, mother's education, Religion, Sources of drinking water, Household Sanitation, Family size, Mother's work status, Father's work status etc.

At first bivariate and multivariate analysis (logistic regression analysis & Cox Proportional Hazard model) are performed to asses the net and interaction effects of the independent variables.

Bivariate Analysis: To determine which factors influence the morbidity status of under – five children of the study population, data is analyzed by the variables which affect morbidity status of under- five children. In case of bivariate analysis, which examines the independent variables individually, that gives only a preliminary notion of how much important each variable is by itself. The examination of percentage in a bivariate analysis is an advantageous first step for studying the relationship between two variables, though these percentages do not allow for qualification testing of that relationship.

For this purpose, it is useful to consider various indexes that measure the extend of association as well as statistical test of the hypothesis that there is no association , chi-square test of independence is performed to the existence of interrelationship among the categories of two in qualitative variables.

Logistic Regression: The method that does not require any distributional assumptions concerning explanatory variables is Cox linear logistic regression model (1970). The logistic regression model can be used not only to identify risk factors but also to predict the probability of success. The model is now widely used in research to asses the influence of various socioeconomic characteristics controlling for the effect of other variables on the livelihood of occurrence of the event of interest. Logistic regression model is useful for situations in which we want to be able to predict the presence or absence of a characteristic or outcome based on values of a set of predictor variables. The advantage of linear logistic regression model over other related models such as multiple regression analysis and discriminate analysis is that these models pose difficulties when the dependent variable can have only two values, an event occurring and not occurring. When the dependent variable can have only values, the assumption necessary for hypothesis testing in regression analysis are necessarily violated. For example, it is unreasonable to assume that the distribution of error is normal. Analysis with multiple regression analysis is that predicted values can not be interpreted as probabilities. They are not considered to fall in the interval between 0 and 1. Linear discriminate analysis does not allow direct prediction of group membership, as well as equal variance- covariance matrices in two groups, is required for the prediction rule to be optional. However, linear logistic regression analysis requires far fewer assumption than discriminate analysis, even when the assumption required for discriminate analysis are satisfied , linear regression still performs well. The logistic regression model is a multivariate technique for estimating the probability that an event occurs. Let Y be a dichotomous dependent variable coded as:

$Y_i = 1$, if the event occurs

$Y_i = 0$, if the event does not occur

Now we can define the dependence of probability of success on the independent variable for single independent variable (X), the logistic regression is of the form:

Prob. (event) = Prob. ($Y_1 = 1$) = $\frac{e^{\beta_0+\beta_1 x}}{1+e^{\beta_0+\beta_1 x}}$

Or equivalently, Prob. (event) = Prob. ($Y_1 = 0$) = $\frac{e^{\beta_0+\beta_1 x}}{1+e^{-(\beta_0+\beta_1 x)}}$

Where β_0 and β_1 are the regression coefficients to be estimated from the data.

For more than one independent variable, the model assumes the form:

Prob. (event) = $\frac{e^z}{1+e^z}$

Or equivalently Prob. (event) = $\frac{e^z}{1+e^{-z}}$

Where Z= $\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots\dots\dots + \beta_k X_k$.

However logarithm of the ratio of P_i and 1- P_i which is called logit of P_i that turns out to be a simple linear function of X_{ij} . We define,

logit (P_i) =ln $\frac{P_i}{1-P_i} = \sum_{j=0}^{k} \beta_j x_{ij} = \beta_0 + \sum_{j=1}^{k} \beta_j x_{ij}$

The logit is the logarithm of the odds of success, that is, the logarithm of the ratio of the probability of success to the probability of failure. The parameters of the model are estimated using the maximum likelihood. That is the coefficients that make our observed results most 'likely' are selected. To understand the interpretation of the logistic coefficients consider a rearrangement of the equation for the logistic model. From the logistic regression model we see that the logistic coefficient can be interpreted as the change in the log odds associated with a one-unit change in the explanatory variable. As it is easier to think of odds, rather than log odds, the equation can be written in terms of odds as:

$$\text{Odds} = \frac{p_i}{1 - p_i} = \exp\left(\sum_{j=0}^{k} \beta_j x_{ij}\right)$$

The exponential raise to the power β_j is the factor by which the odds change when the independent variables increases by one unit.

If β_j is positive, the factor will be greater than 1, means that the odds are increased. If β_j is negative, the factor will be less than 1, means that the odds are decreased.

If β_j is 0, the factor equal 1, which leaves the odds unchanged.

Cox Proportional Hazard Model: A hazard function is defined as the failure rate during a very short interval (t, t+Δt) conditional upon the individual surviving to the beginning to the interval t. For interval (t, t+Δt), the hazard function can be expressed as h (t) $=\frac{1}{\Delta t}$ pr. (an individual fails to survive during the interval (t, t+Δt)); where Δt is an infinitesimal interval of length t. The proportional hazard model is non-parametric in the sense that it involves an unspecified arbitrary base-line hazard function. This model is comparatively more flexible and appropriate for the analysis of survival data with or without censoring and with or without tied failure time. This assumes that the hazard of the study is proportional to that underlying survival distribution. The Cox's proportional hazard model specify that $h(t,z) = h_0(t)e^{z\beta}$ where h_0(t) is an arbitrary unspecified base line hazard function for continuous failure time T and $\beta' = (\beta_1, \beta_2, \ldots\ldots, \beta_p)$ is a vector of p regression parameters and Z is a vector of covariates. In this model the covariates act multiplicatively on the hazard function. If h_0(t)=h then Cox's proportional hazard model reduces to the exponential regression model, as $h(t,z) = he^{z\beta}$.The Weibull regression model is the special case of proportional hazards model with h_0(t)=hp(ht)$^{p-1}$. Then the conditional Hazard is $h(t,z) = hp(ht)^{p-1}e^{z\beta}$ The conditional density function for T given Z corresponding to the Cox's model will be f(t;z)=$h_0(t)e^{z\beta}\exp(-e^{z\beta}\int_0^t h_0(u)du)$ the conditional survivor function for T given z is s(t;z)=$\left[s_0(t)\right]e^{z\beta}$, where $s_0(t) = \exp\left[-\int_0^t h_0(u)du\right]$Thus the survivor function of for a covariate value Z is obtains by raising the base-line survivor function s_0 (t) to a power. The set of models produced by this process is sometimes referred to as the class of Lehman alternatives. For arbitrary h_0 (.) the Cox's model is sufficiently flexible for many applications. There are, however, two important generalizations that do not substantially complicate the estimation of β. First, the nuisance function h_0(t) can be admitted to vary in specific subsets of the data and the second important generalization allows regression variable to depend on time itself. The Cox's model assumes continuous failure time, which may not be practical since in practice it quite likely that the data will be recorded in a form informing ties. To cover this probability, a discrete proportional hazards model was proposed by Cox, 1972 and specified a linear log odds model for the hazard probability at each potential failure time. Cox generalized formally to discrete time by $\frac{h(t;z)dt}{1-h(t;z)dt} = \frac{h_0(t;z)dt}{1-h_0(t;z)dt} ez\beta$

Methods of estimation and Tests

The mathematical form of proportional hazards model is h (t,z) = h_0 (t) $e^{z\beta}$ where, z is a row vector of p measured covariates, β is a column vector of p regression parameters, h_0 (t) is an unspecified bade-line hazard function and T is the associated failure time. The survivor function and density function of T are also given by, S(t:z)=exp[-$\int h_0(u)e^{z\beta}du$] and f(t;z)=h(t;z).s(t;z)

There are several methods for estimating and testing the set of parameters in the model. However the method of partial likelihood is the most commonly used method.

Method of partial likelihood: The general method of partial likelihood was proposed by Cox, 1975. The partial likelihood technique makes useful inferences in the presence of many nuisance parameters. Let us suppose that the data consist of a vector of observations from the density f(y;Θ, β), where β is the vector of parameters of interest and Θ is a nuisance parameter and typically of very high or infinite dimension. In some applications Θ is in fact a nuisance as, for example, the hazard function h_0 (.) in the proportional hazard model. Let us suppose that the data y are transformed into a set of variables $A_1B_1, A_2B_2, \ldots\ldots\ldots, A_mB_m$ in a one to one manner and let $A^{(j)} = (A_1, A_2, \ldots\ldots A_j)$ and $B^{(j)} = (B_1, B_2, \ldots\ldots B_j)$. Suppose that the joint density of $A^{(m)}, B^{(m)}$ can be written as $\prod_{j=1}^{m} f(b_j / b^{(j-1)}, a^{(j-1)}; \theta, \beta) \prod_{j=1}^{m} f(a_j / b^j, a^{(j-1)}; \beta)$ the second term of this function is called the partial likelihood of B based on A in the sequence (A_j, B_j), that is, the partial likelihood B based on A in the sequence (A_j, B_j) is $L(\beta) = \prod_{j=1}^{m} f(a_j / b^{(j)}, a^{(j-1)}; \beta)$ where the number of terms could be random or fixed. In this case it is important to note that the partial likelihood is not likelihood in the ordinary sense. Now in order to apply the partial likelihood method to estimate the parameters of proportional Hazard model let us consider the model $h(t,z) = h_0(t)e^{z\beta}$ Let us consider a sample of n individuals, which are observed to fail at $t_1, t_2, \ldots\ldots t_n$ with corresponding covariates, $z_1, z_2, \ldots\ldots\ldots, z_n$. let us assume that the sample consists of k distinct failure times $t_{(1)} < t_{(2)} < \ldots\ldots\ldots < t_{(k)}$ and for this moment ignore the case of ties. The remaining n-k observations are right censored. Further let $z_{(i)}$ be covariates

ISSN – 2320-0073 Volume II, August'13

corresponding to $t_{(i)}$ be the risk set at time $t_{(i)}$ that is R ($t_{(i)}$) is the set of individuals at risk at $t_{(i)}$-0, and $r_{(i)}$ be the number of individuals in R ($t_{(i)}$). Let $Z_{(i)}$ be the value of the covariates z for the item failing at $t_{(i)}$. Now let B_i specify the censoring and covariate information in $\lfloor t_{(i-1)}, T \rfloor$ plus the information that an individuals fails at $t_{(i)}$, $A_{(i)}$ specifies the particular individuals that fails. Thus the ith term in the partial likelihood is

$$L_i(\beta) = f(a_i / b^{(i)}, a^{(i-1)}) = \frac{h(t_{(i)}; z_{(i)})}{\sum_{i \in R(t_{(i)})} h(t; z_i)} = \frac{\exp|z_i \beta|}{\sum_{i \in R(t_{(i)})} \exp|z_i \beta|}$$

which is same as the conditional probability that item (i) fails at $t_{(i)}$ is at risk and that exactly one failure occurs at $t_{(i)}$. Thus for the proportional hazards model the partial likelihood is given by $L(\beta) = \prod_{i \neq l}^{k} \left[\frac{\exp|z_{(i)} \beta|}{\sum_{l \in R(t_{(i)})} \exp|z_l \beta|} \right]$. If ties are present in the data, the partial likelihood can be obtained by applying similar argument to the discrete logistic model. For this model the hazard relationship is given by $\frac{h(t;z)dt}{1 - h(t;z)dt} = \frac{h_0(t;z)dt}{1 - h_0(t;z)dt} e^{z\beta}$ where $h_0(.)$ an unspecified discrete hazard is giving positive contributions at the observed failure time $t_{(1)}, t_{(2)}, \ldots\ldots, t_{(k)}$. A direct generalization of the above argument can then be used to compute, at each failure time, the probability that the d_i failure should be those observed given the risk set and the multiplicity d_i and the conditional likelihood function for discrete case is given by $L(\beta) = \prod_{i \neq l}^{k} \left[\frac{\exp|s_{(i)} \beta|}{\sum_{l \in R_{d_i}(t_{(i)})} \exp|s_l \beta|} \right]$ where s_i is the sum of the covariates associated with the d_i failures at $t_{(i)}$, $s_l = \sum_{j=1}^{d_j} z_{1j}$ and l=($l_1, l_2, \ldots\ldots, l_d$); $R_{d_i}(t_{(i)})$ is the set of all subsets of d_i items chosen from the risk set $R(t_{(i)})$ without placement.

RESULTS

Table 1. Diarrhea odds ratios for the multinomial logistic regression models of neonatal, post-neonatal and child mortality in Bangladesh

Varriables		Diarrhea odds ratio
Mother's age at birth	15-24 years	3.77***
	25-34 years	2.07*
	Above 35 years (RC)	1.00
Mother's education	no education	1.47**
	primary	1.38+
	secondary & higher (RC)	1.00

Table 1. Diarrhea odds ratios for the multinomial logistic regression models of neonatal, post-neonatal and child mortality in Bangladesh (Contd….)

Varriables		Diarrhea odds ratio
Sex of the child	male female (RC)	1.07 1.00
Drinking water	Piped water Tube well water Others	0.86* 0.64*** 1.00
Wealth index	poor middle rich (RC)	1.14** 1.39 1.00
Preceding birth interval	less than 24 months 24-36 months greater than 36 months(RC)	1.92** 0.66 1.00
Decision on child's health care	respondents alone respondent & husband others (RC)	0.39** 0.44*** 1.00

Note: RC = Reference category

Significance level: +p < 0.10, *p < 0.05, **p < 0.01, ***p < 0.001

CONCLUSION

The measurement of diarrhea from such surveys is complicated and comparison across different background characteristics is difficult. The study discovers an important relationship between diarrheal morbidity and associated independent variables.

REFERENCES

1. Adlakha, A. and Suchindran, C. 1985. "Factors affecting infant and child mortality" Journal of Biosocial science 17(4):481-496
2. Ahmed, S. F. Soabhan, A. Islam and Barkat-e- khuda. 2001. "Neonatal morbidity and care-seeking behavior in rural Bangladesh". Journal of Tropical Pediatrics 47: 98-105
3. Bangladesh Contraceptive Prevalence survey 1985, Secondary Analysis, Mitra and Associates, Dhaka: 64-87.
4. Fosu, Gabriel B. 1994. "Childhood Morbidity and health services utilization: Cross-national comparisons of user related factors from HS data". Social sciences and Medicine 38(9):1209-1220.
5. Frankenberg, E. and Matin K. 1998. "Determinants of child mortality in Bangladesh"
6. Rashid, K.M., M. Kabiruddin and S. Hyder. 1992. "Textbook of community medicine and public health", Dhaka.