EDITORIAL

Application of Mosley's Analytical Framework adopting the Logistic Regression to under five Child Mortality in Gezira State

Huda Mubarak Yousif

Correspondence: Abobakr Osman College, Gezira State, Sudan.
Tel:+249 903035666.E-mail:hudamubarak90@gmail.com

Abstract:

This study aims to enhance and to review the research methodology in the area of under-five mortality and to investigate its most underlying causes. Mosley's framework focuses on the environmental, demographic, social, and economic factors affecting mortality of children under five years. The study population consisted of households in Gezira state. The sample consisted of 1000 households that have at least one child under five years (alive or dead) distributed between the seven localities, using the number of households in Gezira state in each locality as a sub sample frame and then applying stratified random sampling with probability proportional to size for determining the sample size in each of the administrative unit in each locality. Data was collected through questionnaires and was statistically analyzed using Statistical Packages for Social Sciences (SPSS) and Micro Stat software. In addition to frequencies tables, descriptive statistics, statistical tests, cross tabulations and regression analysis were utilized for test of research hypotheses. Important results reveal that the factors affecting under five mortality are the duration of breastfeeding, the type of toilet, the age of the mother, raising animals in or around the house, educational level of the mother, father occupation, and educational level of the father, contraceptive usage, vaccination of tetanus during pregnancy, and finally the number of rooms in the house.

الخلاصة:

تهدف هذه الدراسةلتعزيزومراجعة المنهجية والتطبيقات في مجال وفيات الأطفال دون سن الخامسة. من هذه التطبيقات نموذج الإطار العملي التحليلي لهنري موزليي ذي العوامل المؤثرة على وفيات الأطفال دون سن الخامسة. يركز هذا الإطار العملي على فرز المحددات البيئية والديموغرافية والاجتماعية والاقتصادية التي تؤثر على وفيات الأطفال دون الخامسة. هدفت هذه الدراسة إلى استخدام البيانات لوضع السياسات السليمة لتقليل معدل حدوث وفيات الأطفالوالرضع.يتشكل مجتمع الدراسة من كل الأسر المعيشية في ولاية الجزيرة. ولذلكتم اختيار عينة تحتوى على 1000أسرة بها طفل على الأقل دون الخامسة (حيا أو ميتا)اعتمادا على عدد السكان في كل محلية من محليات ولاية الجزيرة السبعة بتطبيق قواعد المعاينة الطبقية العشوائية المتناسبة بالأوزان. وجمعت البيانات عبراستمارةالاستبيان. ثم تم تحليل هذه البيانات إحصائياباستخدام برنامج الحزم الإحصائية للعلوم الاجتماعية لاستخلاص الإحصاءات الوصفية والجداول التكرارية والاختبارات الإحصائية و الجداولالتقاطعية وبناء نموذج تحليل الانحدار اللوجستي وذلك لاختبار فروض البحث. أظهر هذا التحليل الإحصائي عددا من المحددات المهمة التي تؤثر على وفيات الأطفال دون الخامسة. شملت هذه المؤثرات طول فترة الرضاعة, نوع المراحيض المستعملة و عمر الأم و تربية الحيوانات داخل وحول المنزل و تعليم الأم ووظيفة الأب و تعليم الأب واستعمال موانع الحمل و التطعيم ضد التتنوسإثناء الحمل وعدد الغرف بالمنزل.

EDITORIAL

Introduction:

Reduction of child mortality is the fourth of the United Nations' millennium development goals (MDG). Under- five mortality rates is a leading indicator of the level of child health and overall development in countries. It's also a MDG indicator (WHO 2005). It's 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. This indicator measures child survival. It also reflects the social, economic and environmental conditions in which children live, including their health care. Because data on the incidences and prevalence of diseases (morbidity data) are frequently unavailable, mortality rates are often used to identify vulnerable populations. The under-five mortality rate captures more than 90 percent of global mortality among children under the age of 18 (UN 2003).

Infant mortality rate is the probability of an infant born in a specific year or period dying before reaching the age of one, if subject to age-specific mortality rates of that period (WHO 2006).

Neonatal mortality, covering deaths in the first month after birth, is of interest because the health interventions needed to address the major causes of neonatal deaths generally differ from those needed to address other under- five deaths. Neonatal mortality is increasingly important because the proportion of under- five deaths that occur during the neonatal period increases as under- five mortality declines (UNICEF Sep2011).

Post Neonatal Mortality (PNN): is the difference between infant and neonatal mortality (J.M.Sullivan and N.K.Tureeva 2002).

Prenatal mortality only includes deaths between the foetal viability (22 weeks of gestation) and the end of the 7^{th} day after delivery (Wikipedia 2009).

Infant and child mortality remain disturbingly high in developing countries despite the significant decline in most parts of the developed world. The state of the world's children indicated that about 12.9 million children die every year in developing world (UNICEF, 1987).

Some 70% of the world's under-five deaths in 2010 occurred in only 15 countries, and about half in only five countries: India, Nigeria, Democratic Republic of the Congo, Pakistan and China. India (22%) and Nigeria (11%) together account for a third of under five deaths worldwide (WHO 2011).

Susceptibility and exposure are the important risk factors related to the incidence of infectious disease. Immunization is effective in reducing susceptibility 95% to 100%. These include diphtheria, tetanus, whooping cough, polio, measles, and tuberculosis. There are wide variations in the level of nutrition due to social and economic conditions, malnutrition and infection interact synergistically (Scrimshaw, et al 1968).

During the fetal period the determinants of mortality operate through the mother, who remains the key factor in the infant's health and survival for the first few years of life. These determinants are breastfeeding, physical contact, and mother's health beliefs and health knowledge (education) (Caldwell, 1979). Family setting determines the physical environment in which the child develops. Behaviors vary depending on, knowledge, beliefs, value system, and resources available (Susser

EDITORIAL

and Watson, 1971; Morley, 1973).

Susceptibility coupled with the exposure factors (poor diet and environment), determines the level of illness in the population. The social and economic determinants operate on the susceptibility, exposure and outcome factor to moderate risks of illness and mortality. The utility of this model is that it depicts the physiological states of individuals and allows the quantitative assessment of transition rates through use of either prevalence or incidence rates (W. Henry Mosley 1984).

The relationship between economic resources and child health is well documented (Aber et al. 1997). Families of higher socio- economic status are able to provide better healthcare for their children. Higher socio- economic status is also tied to sanitary living conditions. Such amenities as latrine facilities, piped water, and electricity are critical to children's health (Defo 1997).

There are fundamental principles of optimal physical, socio- emotional and cognitive/ language development that apply to all human beings across cultures and ethnic backgrounds. Social determinants play a critical role in the early phases of conception, pregnancy, and post- natal periods of children's development. Sensitive periods in brain and biological development start prenatally and continue throughout childhood and adolescence. The extent to which these processes lead to healthy development depends upon the qualities of stimulation, support, and nurturance in the social environments in which children live, learn and grow (Richter, 2004).

This study aims to investigate the most significant underlying causes of under-five mortality and their relations with social, economic, demographic, and environmental factors in which the child lives.

Methods:

Conceptual Framework

Health status is viewed in terms of bio-medical, nutritional status and infant feeding, socio-economic, demographic and environmental factors affecting the child. These independent variables (risk factors) affect the binary (dichotomous) dependent variable which is obtained by either the child alive or dead. The dependent and independent (explanatory) variables are defined in Table 1.

The derived estimates, frequencies and cross tabulations of the different variables about the under-five mortality in Gezira State were presented. These results were obtained from the households (specially the mothers) in Gezira State using a questionnaire. The methodology used was, descriptive statistics for the analysis of the sample units and statistics for derivation of population parameters from the sample statistics.

To examine the associations between under five child mortality and the determinants affecting it, asymptotic derived tests are Pearson Chi-Square tests.

Logistic regression is a linear combination of the explanatory variables and a set of regression coefficients that are specific to the model at hand. The linear predictor function f(i) for a particular data point I is written as:

$F(i) = B_0 + B_1X_{1,i} + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots + B_mX_{m,i,}$

Where B_0 ,……., $B_m$are regression coefficients indicating the relative effect of

EDITORIAL

a particular explanatory variable on the outcome. Logistic regression can be binomial or binary, it deals with situations in which observed outcome for a dependent variable can have only two possible types (for example, "dead" vs. "alive" or "win" vs. "loss" (Wikipedia, the free encyclopedia, 2015).

When assessing the contribution of individual predictors in a given model, one may examine the significance of the Wald Statistic.

Table 1: Variables Definition

Variables	Category	Type
Infant and child mortality	Dependent	Binary (dichotomous)
Mother Age	Independent	Numeric
Educational level of mother	Independent	Ordinal
Age of mother at marriage	Independent	Numeric
Age of mother at birth of the first child	Independent	Numeric
Father age	Independent	Numeric
Father Occupation	Independent	Nominal
Duration of breastfeeding	Independent	Nominal
Bottle usage	Independent	String
Abortion	Independent	Numeric
Vaccination of Tetanus	Independent	String
Initiation of breastfeeding after delivery	Independent	Numeric
Causes of deaths	Independent	Nominal
Variables	Category	Type
Weight of the child in kilos	Independent	Numeric
Birth interval	Independent	Numeric
Family size	Independent	Numeric
Toilet facilities	Independent	Nominal
Sanitation	Independent	Nominal
Water source	Independent	Nominal
No of rooms	Independent	Numeric
Kitchen	Independent	Nominal
Contraceptive Usage	Independent	Nominal
Cooking fuel	Independent	Nominal
Electricity	Independent	Nominal
Duration of Breastfeeding	Independent	Nominal
Educational level of Father	Independent	Ordinal
Income level	Independent	Numeric
Health services	Independent	Nominal
Raising animals	Independent	Nominal

The Wald Statistic is the ratio of the square of the regression coefficient to the square of the

EDITORIAL

standard error of the coefficient and is a asymptotically distribution as a chi- square distribution (Menard, Scott W.2002)

$W_i = B_j^2 / SE^2_{Bj}$

The logistic regression shows somewhat different results as concerning the value of p. For a number of cases the p-value in the logistic regression is found to be different from that of the cross-tabulation, and this may be due to auto correlation between the explanatory variables especially when the dependent variable is binary.

Data Sources and Analysis

Information regarding children under five years was collected from mothers that have at least one child under five years either alive or dead. A sample of 1000 households was distributed by using cluster sampling through the localities in Gezira State. After collecting the data through questionnaires, it was coded and analyzed by the Statistical Packages for Social Sciences (SPSS). Frequency tables were obtained for the different variables, then Chi-Square tests were used to test the exposure of children under five years old to the fatal diseases with regard to the socio-economic, demographic and environmental factors that is to say that Chi-Square test has been used to test the associations between the dependent variable and the set of the independent variables. For the confirmation of the Chi-square tests, we resolved to the directional and symmetrical measures for the insignificant variables, finally, we resolved to Logistic Regression so as to arrange these independent variables according to their effects on the dependent variable infant and child mortality.

Table 2: Means and Standard Deviations

Variables	Mean	Standard error	Parameters mean ± (1.96)SE	
			minimum	maximum
Age of mother	30.77	0.223	30.547	30.993
Age of mother at marriage	22.37	0.311	22.059	22.681
Age of mother at birth of the first child	24.24	0.389	23.851	24.629
Incidence of abortion	2.47	0.086	2.384	2.556
Weight of child at birth in kilos	2.99	0.016	2.974	3.006
Birth interval in years	2.30	0.030	2.27	2.33
Time of initiation of breastfeeding after delivery in hours	1.21	0.170	1.04	1.38
Age of the father	39.56	0.290	39.27	39.85
Monthly expenditure in pounds	676.58	12.995	663.585	689.575
Number of rooms in the house	2.70	0.036	2.664	2.736
Number of individuals living at house	5.87	0.082	5.788	5.952

Own survey 2012

EDITORIAL

Results

The means and standard errors and 95% of confidence intervals of the numeric variables are presented in table (2).

To examine the relations between under five mortality and the factors affecting it, asymptotic derived tests from Pearson Chi-Square has resulted in that there is great association between under five mortality and nine independent variables, these variables as shown in table (3) are, the age and the educational level of the mother, vaccination of tetanus during pregnancy, contraceptive usage, duration of breastfeeding, educational level and occupation of the father, the number of rooms and the type of toilet in the house.

The Directional and Symmetrical measures resulted in that the variable raising animals in or around the house has an association with under five mortality. Finally using logistic regression to assess the relationship between the ten independent variables mentioned in table (4) and under five mortality, it reflects significant relationship, that the duration of breastfeeding, the age of the mother, raising animals in or around the house, and the type of toilet, the educational level of mother, vaccination of tetanus, usage of contraceptive, educational level of father, father occupation, and the number of rooms have effect on the number of children dead (under five mortality), this means that the model can put into consideration these ten independent variables.

Table 3: Chi-square test: Significant variables

Variables	Pearson Chi-Square value	Degree of freedom	P. value
Age of mother	97.065	18	0.000
Level of education of mother	65.338	18	0.000
Vaccination of tetanus during pregnancy	24.010	3	0.000
Use of contraceptive methods	13.718	3	0.003
Duration of breastfeeding	53.696	15	0.000
Education of father	25.022	9	0.003
Father occupation	61.478	24	0.000
Number of rooms	38.008	15	0.001
Type of Toilet	28.233	9	0.001

Own survey 2012

EDITORIAL

Table 4: Arranged Significant Variables

Variables	Wald Statistics	P. value
1-Duration of breastfeeding	11.658	0.000
2-Types of Toilet	4.382	0.001
3-Age of mother	2.979	0.000
4-Raising animals	2.285	0.218
5-Education of mother	2.235	0.000
6-Father occupation	1.818	0.000
7-Education of father	1.425	0.003
8-Contraceptive usage	0.791	0.003
9-Vaccination of tetanus	0.584	0.000
10-Number of rooms	0.008	0.001

Own survey 2012

Discussion:

This study found that socio-economic, environmental, and demographic factors have a lot of influence on the health status of children in Gezira State. It reviews the evidence on the magnitude of socio-economic demographic and environmental inequalities in childhood mortality in Gezira state. Firstly, the importance of breastfeeding, which protects children from infections, provides an ideal source of nutrients, and is economical and safe for the child. Secondly, the environmental factors, the type of the toilet, that lack of improved toilet facilities leads to high environmental contamination in the house and makes children more vulnerable to infectious diseases. Also, raising animals in or around the house, and the number of rooms in the house that increases the density in the house, these two variables reflect poor and unhealthy environmental conditions, that affect the health of children and makes them more susceptible to infectious diseases. Concerning the demographic factor, the age of mother, the risk in deliveries increases as the mother gets older in her reproductive age. Regarding the economical factor, it is affected greatly by the occupation and educational level of the father, it was found that few deaths were in families with strict salaries, that leads to economic stability in family'sexpenditures than others, and also few deaths was found in well-educated fathers, which reflects the importance of education in the overall health of children.Regarding the educational level of mother, fewer deaths were found in families with higher mother education, verifying the fact that more educated mothers are expected to know well about health facts and believes concerning their children.

Thus, there are many fundamental and controllable factors, affecting the health status of children under five years, and lead to increased mortality, through increasing susceptibility and exposure of children to fatal diseases.

EDITORIAL

Conclusion:

The study found that socioeconomic, environmental and demographic factors had a lot of influence on the health status of children in Gezira state; it also found that there is great association between under-five mortality and a number of variables. These variables are arranged according to the degree of their effects on under five mortality firstly, the duration of breastfeeding, secondly, the type of toilet, thirdly the age of the mothers, fourthly raising animals in or around the house, fifthly educational level of mother, sixthly father occupation, seventhly education of the father, eighthly contraceptive usage, ninthly vaccination of tetanus during pregnancy, and finally the number of rooms in the house.

EDITORIAL

References:

1. Aber JL et al, 1997The effects of poverty on child health and development. Annual Review of Public Health 18: 463-483.
2. Caldwell, J. C, 1979. "Education as a factor in mortality decline: an examination of Nigerian data. Population Studies 33: 395-413.
3. Defo BK, 1999. Effects of socioeconomic disadvantage and women's status on women's health in Cameroon.Social Science and Medicine 44: 1023-1042.
4. J.M. Sullivan and N.K. Tureeva, 2002Infant and Child MortalityLogistic regression- Wikipedia, the free encyclopedia, 2015-08-19.
5. https://en.wikipedia.org/wiki/Logistic. regression.
6. Menard, Scott W. (2002).Applied Logistic Regression (2nded). SAGA.ISBN 978-0-619-2208-7.
7. Mosley.W.H, 1998. Social determinants of infant and child mortality.Some consideration for analytical framework.
8. Richter, L, 2004. The importance of care giver-child interactions for the survival and healthy development of young children: A Review. Department of Child and Adolescent Health and Development, World Health Organization, CAH.
9. Scrimshaw, et al. 1968.Interaction of Nutrition and Infection. Geneva: World Health Organization.
10. Susser, M. W. and W. Watson, 1971. Sociology in Medicine.Second Edition. London: Oxford University Press.

Reports

1- UNICEF, 1987 The State of the World's children, Oxford University Press.

2- UNICEF, Sep 2011 www. Childinfo.Org/mortality. Html
Infant and Under- five Mortality
www. UNICEF. Org/…/01Wikipedia, the free encyclopedia 2009.

3-Infant mortality

4- World Health Organization, 2005
The World Health Report 2005, Make every mother and child count. WHO/ Health Status Statistics: Mortalitywww.who.int/.../indunder 5 mortality/en/

5 - WHO, 2006. Core Health Indicatorswww.who

6- WHO, 2011 Global Health Observatory (GHO) Mortality and causes of death