Research on Humanities and Social Sciences www.iiste.org
ISSN (Paper)2224-5766 ISSN (Online)2225-0484 (Online)
Vol.6, No.5, 2016

Modeling Determinants of Under-Five Mortality in Rural and Urban Ghana

Eric Boahen
Faculty of Mathematical Sciences,Department of Statistics,University for Development Studies –Tamale

Sampson Wiredu
Faculty of Mathematical Sciences,Department of Statistics,University for Development Studies –Tamale

WISDOM ASELISEWINE
Faculty of Mathematical Sciences,Department of Statistics,University for Development Studies –Tamale

Abstract
The disparity in under-five year-old mortality rates between rural and urban areas in Ghana as also reported in other sub-Saharan African countries is a critical national concern. The purpose of this study is to examine the relative importance of major biosocial, demographic and economic factors associated with child mortality in Ghana. The study is an analytical cross-sectional design through secondary data analysis of the 2008 Ghana Demographic and Health Survey (GDHS) dataset for children. Series of multivariate Cox regression models were fitted to select the significant factors affecting child mortality both in urban and rural. Overall, the likelihood of death among under-five children in the rural areas was significantly higher than that in the urban areas ($p<0.05$). Breastfeeding, twins and size of child at birth were key determinants of mortality in the rural areas, but the influence of region of residence was similar in both rural and urban areas. The magnitude of the significance for each selected variable was tested using the Wald's test, and hence the factors were rank ordered according to their overall P-value. Infant mortality rate in 2008 was 58.489 per 1000. Focus of interventions in child health with a view to achieving the MDG will be on the social and economic empowerment of women via education and employment while breastfeeding promotion will be encouraged. Innovative and targeted strategies are required to address rural poverty and region-specific sociocultural factors in order to improve child survival in rural Ghana, especially twin births.
Keywords: Ghana, rural vs urban, under-five mortality.

1. Introduction

Under-five mortality rate (U5MR) varies globally from place to place, region to region and from continent to continent. Nearly 10 million children worldwide die before their fifth birth-day, with almost all of such deaths occurring in developing countries; sub-Saharan Africa (SSA) alone accounts for almost 50% of these deaths (Black *et al*., 2003; Claeson *et al*., 2003, WHO, 2007; UNICEF, 2008). Countries in sub-Saharan Africa (SSA) have remarkably high rates and were ranked the top worst performers in reduction of child mortality, with very few making progress and the majority experiencing no change or a reversal in gains made some 10 or so years previously. Ghana was ranked forty-seventh (47th) in the world in terms of under-five mortality rate in 2002, with a rate of 100 deaths per 1000 live births (down from 126 per 1000 live births in 1990) and an infant mortality rate (IMR) of 57 per 1000 live births (UNICEF, 2004). However, the rates increased slightly to 111 per 1000 live births and 64 per 1000 live births for under-five and infant mortality respectively for the year 2003 (GSS/NMIMR/ORC Macro, 2004) and in 2008, went down to 80 and 50 per 1000 live births respectively (GSS/GHS/ORC Macro, 2008 preliminary results).

Several studies have shown that child survival in the first 5 years of life is influenced by a myriad of risk factors. For instance, Becher *et al., 2004* quantified the effect of risk factors for childhood mortality in a typical rural setting of Burkina Faso by performing a survival analysis of births within a population from a demographic surveillance system in 39 villages in which child mortality that demonstrated gender-based disparities, (Silverman et al., 2011) varied with socio-economic inequalities (Becher *et al., 2004*) and was influenced by variation in coverage of interventions (Binka et al., 1998).

Previous findings on the effect of birth order were mixed, with some studies reporting that higher order births were associated with increased risk of under-five mortality (Brockerhoff et al., 2000) but others finding, no influence on child mortality (Ronsmans et al., 1996). With regard to the sex of child, a study in Malawi did not find a significant effect on child mortality (Manda, 1999). In Kenya, a study in Nairobi slums showed that male children were significantly more likely to die than female children (Mutisya et al., 2010).

However, findings from a study conducted in India suggested that male children were less likely to die early than female children (Nath et al., 1994). The effect of household socio-economic status on child mortality had also been examined by previous studies (Lawn et al., 2005) but a national study conducted in Tanzania did not find a significant effect of household socio-economic status on infant and child mortality (Mturi and Curtis, 1995).

Existing evidence from studies conducted in the developing countries suggest that poverty is an underlying factor in many cases of child deaths (Lawn et al., 2005). A study using the 2008 Nigeria Demographic and Health Survey found higher odds of child death among the poorest households compared with the richest households in rural Nigeria (Doctor, 2011).

Universally, there is huge literature that focused on the determinants of infant and child mortality. Most of the studies have shown significant association between socio-economic, demographic factors and infant-child mortality (Caldwell, 1979; Debpuur, 2005; Hosseinpoor, 2005; Madise and Diamond 1995), demographic (Hobcraft, 1985; Manda, 1998), biological (Forste, 1994) or environmental factors (Mutunga, 2004) through making use of survey or censuses data.

Regarding the association between socio-economic status and infant and child mortality, Caldwell (1979) reported on the effect of mother's education on reducing child mortality. He put up a theory that mother's education works through changing feeding and care practices, leading to better health seeking behavior and by changing the traditional familial relationships. In supporting Caldwell's explanation, Hobcraft (1993) explained that education can contribute to child survival by making women more likely to marry and enter motherhood later and have fewer children, utilize prenatal care and immunize their children. The results also, however, showed mysterious conclusion that effect of maternal education on child survival is weaker in sub-Saharan Africa (Devlieger, 2005). Evidences from studies that used data of censuses (Tulasidhar, 1993) and demographic surveillance systems (Bhuiyat, 1991) showed the same mortality differential by maternal education. The only identified counter intuitive result, on this association was brought by Adetunji (1995) who had examined the 1986-1987 Ondo State DHS using birth history data from 2 635 women aged 15-49. The study showed that infant mortality is higher in those born to mothers with secondary education compared to uneducated mothers. He suggested that the lower maternal age at birth and less duration of breastfeeding which were associated with this group of women could be responsible for this finding.

However, a Tanzanian study had shown lack of infant and child mortality differentials by such socio-economic factors as maternal education, partner's education, urban/rural residence, and presence of radio in the household. But demographic factors such as short birth interval (less than 2 years), teenage pregnancies (< 20 years) and previous child death were all significantly associated with increased infant and child mortality. There is lack of infant-child mortality differentials by economic status (wealth index), ethnicity and sex of the child (Mturi and Curtis, 1995).

2. Methods

Study design and sampling

This study is an analytical cross-sectional study through secondary data analysis of the 2008 Ghanaian Demographic and Health Survey (GDHS) dataset for children. The 2008 GDHS was a household-based survey, implemented in a representative probability sample of more than 12,000 households selected nationwide. The GDHS collects nationally representative data on women of child-bearing age (15-49 years) and their children. A nationally representative sample of 11,778 households was interviewed, and in half of the households, 4,916 women age 15–49 and 4,568 men age 15–59 were interviewed. This represents a response rate of 99% for households, 97% for women, and 96% for men. This sample was selected in such a manner as to allow for separate estimates of key indicators for each of the 10 regions in Ghana, as well as for urban and rural areas separately.

The 2008 GDHS utilized a two-stage sample design. The number of clusters in each region was calculated by dividing the total allocated number of households by the sample taken of 15 (that is, the number of households per enumeration area (EA). In each region EAs were stratified by urban first and then by rural, and clusters were selected systematically with probability proportional to size. The first stage involved selecting sample points or clusters from an updated master sampling frame constructed from the 2000 Ghana Population and Housing Census. A total of 412 clusters were selected from the master sampling frame divided into 182 clusters in the urban areas and 230 clusters in the rural areas. The clusters were selected using systematic sampling with probability proportional to size. A complete household listing operation was conducted from June to July 2008 in all the selected clusters to provide a sampling frame for the second stage selection of households.

The second stage of selection involved the systematic sampling of 30 of the households listed in each cluster. The primary objectives of the second stage of selection were to ensure adequate numbers of completed individual interviews to provide estimates for key indicators with acceptable precision and to provide a sample large enough to identify adequate numbers of under-five deaths to provide data on causes of death.

Data were not collected in one of the selected clusters due to security reasons, resulting in a final sample of 12,323 selected households. Weights were calculated taken into consideration cluster, household, and individual non-responses, so the representations were not distorted.

3. Model specification

This study makes use of variables available in the GDHS 2008 data. The outcome variable is the hazard ratio (relative risk) of dying in a specific age range of childhood. The age ranges that is used in this paper is:

- **Child mortality ($_4q_1$):** the probability of dying between the exact age one and the fifth birthday.

This included all deaths among children aged 0–59 months born to mothers in the study. The period of inclusion spanned the 5 years preceding the date of interview. The risk factors (independent variables) examined in the study were selected based on scientific literature and included, socioeconomic, demographic and health outcome predictor (biological) variables. The socioeconomic variables used in the study include maternal educational level, mother's occupation, type of place of residence (urban / rural) and wealth index (quintile). The demographic variables used are age of the mother at birth, sex of the child, region of residence, ethnicity. The biological (health outcome predicting variables) include breastfeeding, birth size, twin, and place of delivery. These are specified and defined based on the Mosley and Chen (1984) determinants of childhood morbidity and mortality framework, following the pattern of demographic and health surveys.

The wealth textiles were derived from an index computed using data on the ownership of consumer goods, dwelling characteristics, type of drinking water source, toilet facilities and other characteristics that relate to a household's socioeconomic status. The variables on breastfeeding and place of delivery were selected to examine some aspects of the child care and health seeking behavior of mothers in rural and urban areas. The enumeration areas were classified as urban or rural in the GDHS according to the national definition which includes a set of criteria on population density and availability of specific socioeconomic activities in the area.

4. Methods of Data Analysis

Three levels of analysis-bivariate, specific death rates and multivariate analyses were conducted. The differences in frequency of all-cause under-five mortality between rural and urban areas were assessed using bivariate (Pearson's χ^2) analysis. The multivariate analysis involved the multivariate Cox proportional hazards regression which was used to simultaneously investigate the effects of the demographic, geographic and maternal factors on child mortality. In this regression model, risk factors were included based on the likelihood of an association with childhood mortality seen from a literature search and their level of statistical significance ($p<0.25$) from the bivariate analysis. Separate models were fitted for the overall sample as well as rural and urban residents, and the relative effects were expressed as hazard ratios and the corresponding 95% confidence intervals. At the end of fitting each model, the p-value was used to test the overall significance of the variables selected by the model. The wald's value produced by the test was the measure used to rank-order the explanatory factors in term of their importance in determining the outcome, since the overall wald's and P-values for a factor is a measure for the relative need of that variable in explaining the variability in the outcome (Marindo, 2007).

However, several authors have identified problems with the use of the Wald statistics (Menard 1995; Agresti 1996). This technique is flexible, easy to use and usually gives meaningful interpretation by giving the magnitude and the direction of the association between explanatory and outcome variables (Stata 2006; Kirkwood & Sterne, 2005).

Ethical Considerations

The study involved secondary analysis of data from the 2008-2009 GDHS which excluded participant identifiers.

5. Results

Bivariate Analysis of Risk Factors for Under-Five Mortality

The results of the bivariate analysis of risk factors for under-five mortality in rural and urban areas of Ghana are shown (Table 4.1). Mortality among under-five children was more frequent in rural twins compared with twins born in the urban areas. Similarly, deaths among under-five children differed significantly with the size of child at birth in rural areas compared with urban areas ($P<0.001$). The proportion of under-five deaths that never breastfed were lower in rural areas than those for similar children in urban areas ($P<0.05$). Among the deaths in rural areas, the proportion in private health sector was lower than in this category of health facility in the urban areas. The association of age of mother and sex of child with under-five mortality were not significantly different in either residence location. High prevalence of under-five deaths was seen in the rural areas in the Greater Accra, Eastern, Brong-Ahafo and Northern regions, and in the urban areas of Western, Central, Upper East and West regions. Similarly, higher proportions of under-five deaths were also seen in the rural areas of Guan, Mande and Gruma ethnicity, and in the urban areas Mole-Dagbani and the Grussi ethnicity. Among the deaths in rural areas, the proportion in maternal education in the higher education was higher than in this category of education in the urban areas. The prevalence of under-five deaths was higher among the poorest households in the urban areas and the richest households in the rural areas. The association of mother's occupation with under-five mortality was significantly different with higher prevalence of under-five deaths among rural unemployed mothers than their counterparts in the urban areas.

6. Levels and Differentials

Out of 2992 single and multiple live births that took place between exactly one and five years before the survey, there were 175 deaths before the first birth date giving IMR of 58.5 per 1000 live birth.

The infant mortality rate is calculated from the information drawn from questions asked in the birth history section of the women's questionnaire. In the birth history, for each live birth, information is collected on each sex, month and year of birth, survivorship status and current age or if the child had died, the age at death.

The relationship between child mortality and various socioeconomic and demographic factors are examined. In terms of levels and differentials of infant mortality by some socioeconomic, biological and demographic factors, twin children's have the highest level of IMR whiles almost the same level of child mortality is recorded for children who are born either single or twin. Male children have higher level of IMR than female children who rather have a higher Post-natal mortality rate (PNMR).

Again, Mande children have the highest IMR. Grussi children also have the highest level of PNMR while it is the least in the Ga/Dangme and the Mande groups. Upper west region has the highest level of IMR while Central region has the highest level of PNMR. Whiles urban area shows a higher level of IMR, rural areas show a little level of higher PNMR than in urban areas. Mothers with no education have the highest level of infant and child mortality than the other categories of education in Ghana.

Mothers who are not working also have the highest level of infant and child mortality rates than other categories in Ghana. Poorest households have the highest level of PNMR whiles middle households have highest level of IMR.

7. Multivariate Analysis of Risk Factors for Under-Five Mortality

The results of the multivariate analysis of risk factors for under-five mortality in Ghana are shown (table 4.3a). Overall, child is twin and child size at birth were significant determinants of under-five mortality with the highest likelihood of mortality among children in the rural areas ($P<0.001$). This effect was seen in the overall sample as well as rural areas. The influence of breastfeeding on the likelihood of under-five mortality was not similar in rural and urban areas with children who ever breastfed having significantly lower probability of mortality than children never breastfed. In both rural and urban areas, place of delivery, maternal age and sex of child were not significant determinants of under-five mortality. Among the geographic region of Ghana, Central had significantly greater likelihood ($P<0.05$) of under-five mortality. When disaggregated by place of residence, this association was seen in the Eastern and the Upper West regions in the rural areas and in the Volta, Ashanti, Brong-Ahafo, Northern and the Upper East regions in the urban areas. Ethnicity, maternal education, wealth index and mother's occupation were not also seen as significant determinants of under-five mortality in the overall sample and when disaggregated in rural and urban headings. In the model using the overall sample, place of residence was not a significant determinant of under-five mortality as seen in the hazard ratio 1.04 for rural areas.

Taking the four significant factors without the categories, the results are shown in Table 4.3(b). The Wald estimate for the variable breastfeeding (19.940), twin (17.254) as compared to that of region (12.969) and size of child at birth (7.051).This show that breast feeding is more important in the model as the higher the Wald value, the more important it is. This can be supported by the p-values of the breastfeeding (P-value (0.000) <0.05 at 95% C I), twin (P-value (0.000) < 0.05 at 95% C I), region (p-value (0.000) <0.05) and that of size of the child at birth (P value (0.008)<0.05 at 95% C I).Therefore the independent variables that were significant for under-five mortality are breastfeeding, twin, region and size of the child. The model for the under-five mortality is therefore given as Predicted Log(child Mortality)=logλ_0(t)-0.733*Breastfeeding+0.950*Twin+0.099*Region+0.304*Size. Inspecting the values of the SEs in Table 4.3(c) ranging from 0.028-0.229 is within the acceptable criterion, that is, must be between 0.001-5.000(Chan,2004) and shows that multicolinearity does not exist among the independent variables. This implies that the model is statistically stable.

8. Multivariate Analysis

Two different models were fitted for child mortality rates in rural and urban areas separately. The results show the adjusted odd ratios, 95% confidence interval and the associated p-values of the critical predictor of under-five mortality in this study. The overall p-value for each predictor as measured by the Wald's test is also presented. We want to consider the predictor region, with the categories as shown in Tables 4.4(a) below to come out with the appropriate model for the urban level factors. The Wald estimate for the categorical variable according to each region are given. For instance, the wald's estimate for Volta region (16.139), Brong-Ahafo region (10.086) and Northern region (9.780) as compared to that of the other regions are exceedingly higher. This show that those regions (Volta followed by Brong-Ahafo and then Northern) are more important in the model as the higher the Wald value, the more important it is. This can be supported by the p-values of the Volta region (P-value (0.000) <0.05 at 95% C I), Brong-Ahafo (P-value (0.001) < 0.05 at 95% C I), Northern (p-value (0.002) <0.05) and so on. The model for the urban level will then be: Predicted Log(child-Mortality)=logλ_0(t)+Western-1.365*Central-1.713*Volta-1.998*Eastern-1.833*Ashanti-1.301*Brong-Ahafo-2.037*Northern-1.331*Upper East. Inspecting the values of the SEs in table 4.4(b) ranging from 0.410-0.769 is within the acceptable criterion, that is, must be between 0.001-5.000(Chan, 2004) and shows that multicolinearity does not exist among the independent variables. This implies that the model is statically stable. Also, taking the four significant factors without the categories, the results are shown in Tables 4.4(b). The Wald estimate for the variable breastfeeding (18.439), twin (15.572) as compared to that of region (9.204) and size of child at birth (5.937).This show that breast feeding is more important in the model as the higher the Wald value, the more important it is. This can be supported by the p-values of the breastfeeding (P-value (0.000) <0.05 at 95% C I), twin (P-value (0.000) < 0.05 at 95% C I), region (p-value (0.002) <0.05) and that of size of the child at birth (P value (0.015)<0.05 at 95% C I).Therefore the independent variables that were significant for under-five mortality are breastfeeding, twin, region and size of the child. The model for the under-five mortality is therefore given as Predicted Log(child Mortality)=logλ_0(t)-0.888*Breastfeeding+1.090*Twin+0.105*Region+0.339*Size. . Inspecting the values of the SEs in Table 4.4(c) ranging from 0.035-0.276 is within the acceptable criterion, that is, must be between 0.001-5.000(Chan,2004) and shows that multicolinearity does not exist among the independent variables. This implies that the model is statistically stable.

9. DISCUSSION

This study intended to identify the socioeconomic determinants of under-five mortality as well as quantifying their impact with a view to identifying the relative importance of each variable. This study has found a very wide variation in the level of infant mortality rate and child mortality rate between single and multiple births (singleton and twin) in Ghana. For instance, the infant mortality rate for twins, (2 or more), was almost the triple of that for singleton. This disparity, which has been observed in national surveys and other studies in Ghana and other Sub-saharan countries (Houweling et al., 2006) has been ascribed to inequalities in location, socioeconomic factors, socio-cultural beliefs and practices and individual level risk factors in the population (Doctor, 2011 and Swenson, 1993). Regarding the mortality differentials by sex, the males had higher infant mortality compared to females. This is consistent with many studies that have reported the decrease of the females' advantage while ascending in the child age (Bhuiyat, 1991). Greater variations in the levels of infant and child mortality rates also exist between the different ethnic groups in Ghana. Infant mortality rate of Mande-Busanga was almost 4 times that of Ewe and Guan. This may be attributed to socio-economic inequalities between these ethnic groups. The results also showed that whiles some regions, such as Western and Eastern, recorded zero child mortality rates, other regions like the Central and the Brong-Ahafo had higher child mortality rates. Regarding child mortality rate, Upper West region had the highest compared with other regions. Similar variability between regions has been reported elsewhere (Hosseinpoor, 2005). As stated earlier, this disparity observed in this study and many others in Ghana and sub-saharan countries are attributed to inequalities in location, socio-economic and cultural factors and beliefs and the individual level risk factors in the population,

One surprising finding is that there is no great difference in infant and child mortality levels between rural and urban areas. Furthermore, there was a big difference in the levels of infant and child mortality rates between mothers with higher education and the other categories under education. Whiles mothers with higher education had zero child mortality rate, the other categories, except secondary education, had rates exceeding 10 deaths per 1000. In terms of infant mortality, the other categories had rates which were triple its value, with those without education dominating. This due to the fact that education increases a mother's level of knowledge and skills, thus enabling her to effectively understand and utilize available information and resources critical for child health and survival (Deribew et al., 2007)

The results showed consistent relationship between socio-economic status, measured by occupation and infant and child mortality. Whiles non-working mothers had the highest rates for both infant and child mortality; business people had higher infant mortality level than farmers. The results also showed inconsistent relationship between wealth index and infant and child mortality rates. While poorest households had the highest child mortality, middle households had the highest infant mortality. This is difficult to explain and need more detailed examination about the data collection and the wealth index as a valid tool for measuring socio-economic status.

The multivariate analysis showed that apart from birth status (twins or not), birth size, breastfeeding and region of residence, all other selected socio-economic factors (place of delivery, maternal age, sex of child, ethnicity, maternal education, wealth index, mother's occupation and place of residence) had no significant relationship with child mortality at both rural and urban levels. The results have implied very high p-value, thus, excluding even the presence of weak association. The association of under-five mortality with biological variables, namely, child is twin, birth size and breastfeeding, was not similar for both rural and urban children. The results highlight differences in risk factors for under-five mortality between rural and urban areas in Ghana. The effects of breastfeeding, child is twin and size of child at birth were significant only in rural areas regarding their impact on child deaths. A lower likelihood of under-five deaths associated with twins in urban areas compared with rural areas. This is consistent with other studies and may suggest that levels of awareness of child health care are greater among urban women, especially the more educated mothers (Houweling, 2006). Due to lack of improved modern health facilities, high level of poverty in the rural areas couple with cultural beliefs and knowledge, rural women may not be mature enough to deal with the requirements of child mortality as determine by the variable child is twin.

The association of under-five mortality with the birth size of the child was only seen in rural areas and the overall sample. The effect brought the no significant difference between average and small birth sizes regarding their impact on child mortality in urban areas. Though this was not significant in urban areas, the hazard ratio is indicative of higher likelihood of survival among urban twins.

Apart from the other significant biological variables examined in this study, the duration of breastfeeding was also a significant determinant for under-five mortality. Numerous studies showed that children who never breastfed had greater risk of death compared with those who ever breastfed for some periods (Edmond et al., 2006).

Of the demographic variables already examined in this study, only region of residence was a significant risk factor for under-five mortality. The high likelihood of under-five mortality in both rural and urban areas is seen in Central region of Ghana. The urban areas of all regions other than Greater Accra and Upper West had significantly higher under-five mortality compared with the corresponding rural areas. Factors that may underlie these observed outcomes include a higher proportion of the population are found in these areas.

The lower probability of dying in childhood period for females compared to males is consistent with many studies all over the world (Bobak, 2000; Hill, 2001; Gemperli, 2004). It has been reported that for biological reasons, males are more prone to die in the first months of life. Then the probability is almost the same after overcoming the exclusive breastfeeding period (4 months) and was also evident in Matlab DSS site in Bangladesh (Bhuiyat, 1991). Interestingly, Mutunga (2004) who used 2003 Kenyan Demographic Health Survey data to examine the relationship between child mortality and some environmental factors found no sex differentials in child mortality.

The absence of a relationship between maternal education attainment and mortality in both rural and urban areas of Ghana is surprising, given evidence in literature of lower child mortality rates being associated with higher maternal education (Deribew, 2007). However, in the urban areas, the hazards ratios were indicative of a lower risk of child mortality, although this was statistically significant.

However, adjusting for all explanatory factors in the multivariate analysis showed lack of socio-economic differentials for child mortality both in rural and urban areas. The determinants of deaths at this age seemed to be biological and demographic factors. This lack of association, even for maternal education, had been seen in one study conducted in Tanzania in 1995. Mturi and Curtis had found that socio-economic factors like; maternal education, rural/urban residence and wealth index all no association with child mortality. They explained this to be artifact of Tanzania government successful policies on developing the rural areas through provision of health, primary education and clean water supply. The overwhelming significance of association between region of residence and mortality could be the key in explaining the lack of significance as supported by evidence by Brockerhoff (2000) and Antobam (2006). That is, in Ghana and other sub-saharan countries, the effects of socio-economic inequalities between the different regions undermine the effect of maternal education.

However, the model fitted for rural and urban areas showed a slight different. In the rural areas, breastfeeding, child is twin, region and birth size of the child at birth have significant impact on the probability of deaths, while only region of residence in the case of urban areas. Such a different is supporting the Wang's (2003) theory that factors affecting infant-child mortality difference between rural and urban area

10 Conclusions

This study examined the socioeconomic determinants of child mortality in Ghana at both urban and rural settings. Results from the fitted multivariate regression models shown lack of significant socioeconomic association with child mortality and place of residence in Ghana. This can be due to the nature of the occupations available in rural areas which is usually manual (like agriculture), so women are not available for long time to care for their children. While in the Urban areas, because of the assumed differences in the availability of health services, the survival of the child is determined by his/her mother's region of residence. The study showed that biological and demographic variables are more important determinants of child mortality. The predictors of the survival probability are dominated by the demographic factor (region) in both urban and rural areas. In addition, breastfeeding, child is twin and size of child at birth, are the most important factors in rural areas.

The most important determinants of child mortality are breastfeeding and twin followed by region and the least is the size of the child at birth. Once the child has survived the first month, region becomes the most important determinant of mortality in both urban and rural settings, then, followed in sequence by breastfeeding status, twin, size of child, and the least significant ones are the mother's age and her highest level of education which though are insignificant but have p-values less than 0.10. Infant mortality rate was approximately 58 deaths per 1000 live births, which was higher than childhood mortality rate.

REFERENCES

Adetunji, J. A. (1995). Infant Mortality and Mother's Education in Ondo State, Nigeria. *Social Science and Medicine*. **40(2),** pp**:** 253-263.

Agresti, Alan (1996).*An Introduction to Categorical Data Analysis.* John Wiley and Sons, Inc.

Becher H, Muller O, Jahn A (2004). Risk factors of infant and child mortality in rural Burkina Faso. *Bull World Health Organ*. 82:265–73.

Bhuiyat, A. and K. Streatfield. (1991). Mothers' Education and Survival of Female Children in a Rural Area of Bangladesh.*Population Studies*. 45:253-264.

Binka FN, Indome F, Smith T(1998). Impact of spatial distribution of permethrin-impregnated bednets on childhood mortality in rural northern Ghana. *Am J Tropical Med Hygiene*; 59:80–5.

Black RE, Morris SS, Bryce J. Where and why are 10 million children dying every year? *Lancet 2003*.**361(9376),** pp**:** 2226-2234.

Brockerhoff M, Hewett P (2000). Inequality of child mortality among ethnic groups in sub-Saharan Africa *Bulletin of the World Health Organisation*. **78(1),** pp**:** 30-41.

Caldwell, J.C. (1989). Mass education as a determinant of mortality decline. In: Caldwell, J.C. and Santow, G. (eds.). Selected readings in the cultural, social and behavioural determinants of health. Canberra: *The Australian National University*. pp:101- 109.

Caldwell, J. C. (1979), Education as a Factor in Mortality Decline: An Examination of Nigerian Data.

Cox, D. R. 19 72. "Regression Models and Life Tables (with Discussion)." *Journal of the Royal Statistical Society,* Series B 34:187—220

Debpuur, C., P. Wontuo, J. Akazili and P. Nyarko (2005). Health Inequalities in the Kassena-Nankana District of Northern Ghana. *In: Indepth Network (2005).*Measuring Health Equity in Small Areas; Findings from Demographic Surveillance Systems. *1st Edition, Ashgate*, *UK*, Pp: 45-65.

Deribew A, Tessema F, Girma B. Determinants of under-five mortality in Gilgel Gibe Field Research Center, Southwest Ethiopia. *Ethiopian Journal of Health Development 2007*.**21(2),** pp**:** 117-124.

Devlieger, H., G. Martens and A. Bekaert (2005). Social inequalities in perinatal and infant mortality in the northern region of Belgium (the Flanders). *European Journal of Public Health*. **15(1), pp:** 15–19.

Doctor HV. Does living in a female-headed household lower child mortality? The case of rural Nigeria. Rural and Remote Health 11: 1635. (Online) 2011. *Available: www.rrh.org.au (Accessed 23 January 2012).*

Ettarh RR, Kimani J. Determinants of under-five mortality in rural and urban Kenya.*Rural and Remote Health 12: 1812*. (Online) 2012. Available: http://www.rrh.org.au

Forste, R. (1994): The Effects of Breastfeeding and Birth Spacing on Infant and Child Mortality in Bolivia. *Population Studies*.**48**, pp: 497-511. Ghana Statistical Service (GSS), Ghana Health Service (GHS), and ICF Macro, Ghana Demographic and Health Survey (GDHS) 2008, GSS, GHS, and ICF Macro, Accra, Ghana, 2009.

Hisham Elmahdi Mustafa, Lecturer, University of Khartoum, musth344@yahoo.com Clifford Odimegwu*, Professor, Universityof the Witwatersrand, Clifford.Odimegwu@wits.ac.za

Hobcraft, J. N., J. W. McDonald, and S. O. Rutstein. (1984). Socio-economic factors in infant and child mortality: A cross-national comparison. *Population Studies.***38**, pp: 193–223.

Hobcraft, J. (1993): Women's education, child welfare and child survival: a review of the evidence. *Health Transition Review*,**3(2),** pp**:** 159-173.

Hobcraft, J. N., J. W. McDonald and S. O. Rutstein. (1985): Demographic Determinants of Infant Early Child Mortality: A Comparative Analysis. *Population Studies*.**39**, pp: 363-385.

Hosseinpoor, A. R., K. Mohammad, R. Majdzadeh, M. Naghavi, F. Abolhassani, A. Sousa, N. Speybroeck, H. R. Jamshidi, and J.

Vega. (2005): Socioeconomic inequality in infant mortality in Iran and across its provinces. *Bulletin of the World Health Organization*; **83(11),** pp**:** 837-844.

Houweling TA, Kunst AE, Moser K, Mackenbach JP (2006). Risingunder-5 mortality in Africa: who bears the brunt? *Tropical*

Medicineand International Health. **11(8),** pp: 1218-1227. Lawn JE, Cousens S, Zupan J (2005). 4 million neonatal deaths:When? Where? Why? *Lancet 2005*.**365**, pp: 891-900.

Madise, N.J (2003): Infant mortality in Zambia: Socioeconomic and demographic correlates. *Social Biology*. Accessed from www.findarticles.com/p/articles/mi_qa3998, on 04/01/2008.

Manda SO (1999). Birth intervals, breastfeeding and determinants of childhood mortality in Malawi. *Social Science & Medicine*. **48(3),** pp**:** 301-312 Mosley, W. Henry, and Lincoln Chen. 1984. An analytical framework for the study of child survival in developing countries. In W. Henry Mosley and Lincoln Chen, eds. Child survival: Strategies for research. *Population and Development Review 10(suppl.).* pp: 25–45.

Mturi AJ, Curtis SL (1995). The determinants of infant and child mortality in Tanzania. *Health Policy Planning*. **10(4)**, pp: 384-394.

Mutisya M, Orindi B, Emina J, Zulu E, Ye Y (2010). Is mortality among under-five children in Nairobi slums

seasonal? Tropical Medicine and International Health. **15(1),** pp**:** 132-139.
Mutunga, C. J. (2004). Environmental Determinants of Child Mortality in Kenya. *Kenya Institute for Public Policy Research andAnalysis (KIPPRA),Nairobi Kenya.*http://www.webmeets.com/files/papers/ERE/WC3/405/World%20Congress%20Paper.pdf (Accessed 21/09/2006).
Nath DC, Land KC, Singh KK (1994). Birth spacing, breastfeeding, and early child mortality in a traditional Indian society: a Hazards model analysis. *Social Biology*. **41(3-4),** pp: 168-180.
Ronsmans C (1996). Birth spacing and child survival in rural Senegal. *International Journal of Epidemiology*. **25(5),** pp**:** 989-997.
Silverman JG, Decker MR, Wirth K (2011). Gender-based disparities in infant and child mortality based on maternal exposure to Spousal violence: the heavy burden borne by Indian girls. *Archiv Pediatric Adolesc Med 2011*. **165** pp: 22–7.
Tulasidhar, V. B. (1993): Maternal education, female labour force participation and child mortality: evidence from the Indian Census. *Health Transition Review*. **3(2),** pp: 177-190.
Unicef. The State of the World's children, 2006 and 2010. *Unicef Annual Report*.
United Nations, Millennium development goals, in Proceedings of the UN Millennium Summit.*2000, New York, NY, USA, September, 2000*.

APPENDIX

Table 4.1: Percentage distribution of under-five deaths by some of the selected explanatory factors disaggregated by urban /rural residency in Ghana (GDHS, 2008)

Variable	Overall			Rural			Urban			
	Total live births	Total under-five deaths		Total live births	Under-five deaths		Total live births	Under-five deaths		χ^2 test for rural vs urban
		N	%		N	%		N	%	
Total	2992	197	6.6	1992	131	6.6	1000	66	6.6	
Biological Variables										
1. Child is twin										$\chi^2(1)=105.029$*
Singleton	2860	174	6.1	1916	115	6.0	944	59	6.3	
2 or more	132	23	17.4	76	16	21.1	56	7	12.5	
2. Birth size										$\chi^2(2)=109.011$*
Large	1617	88	5.4	1038	56	5.4	579	32	5.5	
Average	1202	57	4.7	833	41	4.9	369	16	4.3	
Small	154	52	33.8	108	34	31.5	46	18	39.1	
Breast feeding										$\chi^2(1)=115.661$*
Never breastfed	1798	177	9.8	1167	60	5.1	631	60	9.5	
Ever breastfed	1194	20	1.7	825	14	1.7	369	6	1.6	
3. Place of delivery										$\chi^2(2)=527.316^*$
Home	1357	94	6.9	1192	84	7.1	165	10	6.1	
Public health sector	1388	85	6.1	708	43	6.1	680	42	6.2	
Private health sector	235	12	5.1	84	2	2.4	151	10	6.6	
Demographic variables										
1. Age of mother										$\chi^2(1)=1.011$
$< 18\ years$	23	0	0	13	0	0	10	0	0	
$\geq 18\ years$	2934	192	6.5	1950	128	6.6	984	64	6.5	
2. Sex of child										$\chi^2(1)=0.006$
Male	1526	105	6.9	1015	70	6.9	511	35	6.9	
Female	1466	92	6.3	977	61	6.2	489	31	6.3	
3. Region of residence										$\chi^2(9)=514.561^*$
Western	270	9	3.3	176	4	2.3	94	5	5.3	
Central	227	19	8.4	164	11	6.7	63	8	12.7	
Greater Accra	279	15	5.4	35	4	11.4	244	11	4.5	
Volta	245	7	2.9	186	5	2.7	59	2	3.4	
Eastern	261	16	6.1	186	13	7.0	75	3	4.0	

Ashanti	439	27	6.2	248	14	5.7	191	13	6.8	
Brong-Ahafo	266	12	4.5	174	9	5.2	92	3	3.3	
Northern	479	47	9.8	373	40	10.7	106	7	6.6	
Upper East	227	10	4.4	195	7	3.6	32	3	9.4	
Upper west	299	35	11.7	255	24	9.4	44	11	25.0	
Ethnicity										$\chi^2(8)=178.782^*$
Akan	1134	64	5.6	661	37	5.6	473	27	5.7	
Ga/Dangme	141	9	6.4	76	4	5.3	65	5	7.7	
Ewe	367	13	3.5	247	8	3.2	120	5	4.2	
Guan	81	5	6.2	61	5	8.2	20	0	0	
Mole-Dagbani	767	56	7.3	555	37	6.7	212	19	9.0	
Grussi	161	13	8.1	129	9	7.0	32	4	12.5	
Gruma	201	25	12.4	195	25	12.8	6	0	0	
Mande	24	4	16.7	10	2	20	14	2	14.3	
Others	114	8	7.0	56	4	7.1	58	4	6.9	
Socio-economic Variables										
1. Maternal education										$\chi^2(3)=337.064^*$
No education	1132	86	7.6	943	69	7.3	189	17	9.0	
Primary	722	53	7.3	493	31	6.3	229	22	9.6	
Secondary	1070	57	5.3	542	30	5.5	528	27	5.1	
Higher	65	1	1.5	11	1	9.1	54	0	0	
2. Wealth index										$\chi^2(4)=1432.262^*$
Poorest	973	72	7.4	954	70	7.3	19	2	10.5	
Poorer	656	35	5.3	579	30	5.2	77	5	6.5	
Middle	504	38	7.5	275	18	6.6	229	20	8.7	
Richer	502	32	6.4	151	8	5.3	351	24	6.9	
Richest	357	20	5.6	33	5	15.2	324	15	4.6	
3. Mother's occupation										$\chi^2(3)=665.587^*$
Not working	300	23	7.7	160	13	8.1	140	10	7.1	
Business	1028	71	6.9	451	31	6.9	577	40	6.9	
Farming	1190	80	6.7	1111	75	6.8	79	5	6.3	
Skilled/professional	460	22	4.8	261	11	4.2	199	11	5.5	
4. Type of place of residence										$\chi^2(1)=0.016$
Rural	1992	131	6.6	-	-	-	-	-	-	
Urban	1000	66	6.6	-	-	-	-	-	-	

Table 4.2: Levels and differentials of Infant mortality rate by selected maternal socioeconomic background variables (GDHS, 2008)

No.	Variable	Category	Infant mortality rate (per 1000)	Child mortality rate (per 1000)
1.	**Child is twin**	Singleton	53.497	**7.692**
		Two or more	**166.667**	7.576
2.	**Sex of child**	Male	**63.565**	5.898
		Female	53.206	**9.550**
3.	**Ethnicity**	Akan	52.910	4.409
		Ga/Dangme	63.830	0
		Ewe	32.698	2.725
		Guan	37.037	24.691
		Mole-Dagbani	65.189	7.823
		Grussi	43.478	**37.267**
		Gruma	114.428	9.950
		Mande	**166.667**	0
		Others	61.404	8.772
4.	**Region**	Western	37.037	0
		Central	66.079	**17.621**
		Greater Accra	50.179	3.584
		Volta	24.490	4.082
		Eastern	61.303	0
		Ashanti	59.226	2.278
		Brong-Ahaf0	30.075	15.038
		Northern	85.595	12.526
		Upper East	39.648	4.405
		Upper West	**100.334**	16.722
5.	**Place of residence**	Rural	57.731	**8.032**
		Urban	**60.000**	7.000
6.	**Mother's education**	No education	**64.488**	**11.484**
		Primary	62.327	11.080
		Secondary	52.336	1.869
		Higher	15.385	0
7.	**Mother's occupation**	Not working	**66.667**	**10.000**
		Business	63.230	6.809
		Farming	58.824	8.404
		Skilled/professional	41.304	6.522
8.	**Wealth index**	Poorest	63.721	**10.278**
		Poorer	45.732	7.622
		Middle	**65.476**	9.921
		Richer	59.761	3.984
		Richest	56.022	2.801
Total			58.489	7.687

Table 4.3(a): Hazard ratio estimates for determinants of under-five mortality in rural and urban Ghana.

Determinant	Overall		Rural		Urban	
	HR	95% CI	HR	95% CI	HR	95% CI
Biological Variables						
1. Child is twin (ref: Singleton)						
2 or more	0.39**	0.25-0.63	0.333**	0.19-0.59	0.622	0.26-1.52
2. Birth size(ref: Large)						
Average	0.44**	0.27-0.74	0.389**	0.21-0.72	0.474	0.17-1.30
Small	0.58**	0.35-0.97	0.525*	0.29-0.97	0.537	0.20-1.48
Breastfeeding(ref: Never breastfed)						
Ever breastfed	1.99**	1.44-2.76	2.246**	1.49-3.39	1.596	0.92-2.78
Place of delivery(ref: Home)						
Public health sector	0.94	0.49-1.80	2.26	0.53-9.66	0.66	0.26-1.66
Private health sector	0.91	0.50-1.67	2.072	0.49-8.84	0.64	0.31-1.31
Demographic variables						
1. Age of mother(Ref: $< 18 years$)						
≥ 18 $years$	0	0	0	0	0	0
2. Sex of child(ref: Male)						
Female	1.12	0.84-1.50	1.132	0.79-1.62	1.134	0.68-1.90
3. Region of residence(ref: Western)						
Central	0.26**	0.11-0.62	0.23*	0.06-0.82	0.288*	0.08-1.05
Greater Accra	0.49	0.21-1.14	0.468	0.15-1.43	1.92	0.16-2.33
Volta	0.35*	0.14-0.85	0.867	0.18-4.14	0.198**	0.06-0.69
Eastern	0.23**	0.08-0.65	0.303	0.09-1.08	0.168	0.02-1.21
Ashanti	0.41*	0.18-0.94	0.713	0.25-2.05	0.166*	0.04-0.78
Brong-Ahafo	0.37**	0.18-0.77	0.434	0.16-1.16	0.287*	0.09-0.91
Northern	0.30**	0.14-0.67	0.456	0.18-1.16	0.157**	0.04-0.69
Upper East	0.56	0.31-0.99	0.750	0.32-1.54	0.142**	0.04-0.50
Upper west	0.35**	0.17-0.74	0.348*	0.14-0.85	0.288	0.06-1.39
4. Ethnicity(ref: Akan)						
Ga/Dangme	1.11	0.49-2.52	0.828	0.26-2.61	1.062	0.29-3.84
Ewe	1.36	0.49-3.79	0.654	0.15-2.94	2.33	0.50-10.8
Guan	0.88	0.33-2.35	0.546	0.15-2.07	1.03	0.20-5.17
Mole-Dagbani	1.22	0.38-3.87	1.326	0.34-5.12	0	0
Grussi	0.96	0.44-2.13	0.818	0.27-2.48	1.103	0.30-4.01
Gruma	1.03	0.39-2.73	0.823	0.22-3.10	1.68	0.35-7.98
Mande	1.85	0.75-4.61	1.264	0.42-3.85	0	0
Others	3.06	0.80-12.05	3.95	0.67-23.4	1.247	0.12-12.6
Socio-economic Variables						
1. Maternal education(ref: No education)						
Primary	4.36	0.57-33.10	0.781	0.09-7.12	0	0
Secondary	5.30	0.71-39.78	0.935	0.10-8.62	0	0
Higher	4.09	0.55-30.31	0.84	0.09-7.71	0	0
Wealth index(ref: poorest)						
Poorer	0.87	0.39-1.93	0.395	0.11-1.39	2.948	0.50-17.3
Middle	0.79	0.38-1.65	0.384	0.11-1.31	1.124	0.35-3.62
Richer	1.01	0.53-1.92	0.454	0.13-1.58	1.595	0.73-3.48
Richest	0.96	0.53-1.77	0.450	0.12-1.67	1.47	0.57-2.32
2. Mother's occupation(ref: Not working)						
Business	1.40	0.76-2.57	1.242	0.55-2.82	1.27	0.50-3.27
Farming	1.40	0.85-2.30	1.358	0.68-2.73	1.13	0.55-2.33
Skilled/professional	1.24	0.73-2.10	1.332	0.68-5.6	1.027	0.32-3.33
Type of place of residence(ref: urban)						
Rural	1.04	0.66-1.65				

HR, Hazard ratios;
NR, no rural population.
†HR computed using Spss.
*p<0.05; **p<0.01.

Table 4.3(c): Summary Results for Significant Risk Factors of Under-five Mortality (Overall)

Predictor	B	SE	Wald	Df	Sig.	Exp(B)	95.0% CI for Exp(B)	
							Lower	Upper
Region	.099	.028	12.969	1	.000	1.104	1.046	1.166
Twin	.950	.229	17.254	1	.000	2.586	1.652	4.049
Breastfeeding	-.733	.164	19.940	1	.000	.480	.348	.663
Size	.303	.114	7.051	1	.008	1.354	1.083	1.693

Table 4.4(b): Results of multivariate analysis for factors associated with child mortality in the rural areas (Model 2.)

Predictor	B	SE	Wald	df	Sig.	Exp(B)	95.0% CI for Exp(B)	
							Lower	Upper
Breastfeeding	-.888	.207	18.439	1	.000	.411	.274	.617
Twin	1.090	.276	15.572	1	.000	2.973	1.731	5.109
Region	.105	.035	9.204	1	.002	1.111	1.038	1.188
Size	.339	.139	5.937	1	.015	1.403	1.068	1.842

Table 4.4(a): Results of multivariate analysis for factors associated with child mortality in the urban areas (Model 1).

	B	SE	Wald	df	Sig.	Exp(B)	95.0% CI for Exp(B)	
							Lower	Upper
Western			25.906	9	.002			
Central	-1.365	.508	7.236	1	.007	.255	.094	.690
Greater Accra	-.677	.465	2.125	1	.145	.508	.204	1.263
Volta	-1.713	.426	16.139	1	.000	.180	.078	.416
Eastern	-1.998	.769	6.756	1	.009	.136	.030	.612
Ashanti	-1.833	.651	7.916	1	.005	.160	.045	.574
Brong-Ahafo	-1.301	.410	10.086	1	.001	.272	.122	.608
Northern	-2.037	.651	9.780	1	.002	.130	.036	.468
Upper East	-1.331	.483	7.581	1	.006	.264	.102	.681
Upper West	-.981	.651	2.268	1	.132	.375	.105	1.344