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A STUDY OF THE DETERMINANTS OF ANAEMIA AMONG UNDER-FIVE CHILDREN IN GHANA

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ABSTRACT

In spite of the numerous interventions in place to control anaemia in Ghana, the prevalence of anaemia among under-five children is still high and classified as a severe public health problem. The study examined socio-demographic factors influencing anaemia among under-five children using the Ghana Demographic and Health Survey data of 2008. The general objective of the study was to assess socio-demographic characteristics of household associated with anaemia among under-five children in Ghana. The logistic regression estimates identified a significant relationship between the prevalence of anaemia in children and a set of socio-demographic variables. For instance, children who were aged 6-24 months were at a higher risk of anaemia compared to children aged 25-59 months. Children of fathers with lower level of education were more likely to be anaemic. In conclusion, it was found that child age, mother's age, place of resident and father's level of education were important determinants factors of anaemia in Ghana. It is recommended that Ghana Health Service should provide appropriate education on complementary feeding for mothers with under-five children in order to reduce prevalence of anaemia. Also, education on anaemia by MOH and GHS should target not only mothers, but fathers as well especially those with low level of education.

INTRODUCTION

In malaria endemic country such as Ghana, anaemia is one of the common causes of death in children under 5 years and in pregnant women (GSS *et al*., 2009). It has also been described as the second leading cause of death among children in in-hospital mortality in Ghana (MOH, 2007). Controlling anaemia in Ghana will contribute to efforts that various agencies are making to meeting Millennium Development Goals One, Four and Six (Eradicate Extreme Poverty and Hunger, Reduce Child Mortality, Combat HIV/AIDS, Malaria and other Diseases). Epidemiological mapping of prevalence of anaemia requires cut off levels or criteria for grading the public health severity of anaemia. The World Health Organisation considers anaemia prevalence rate of over 40% in a population to be a major public health concern (WHO, 2008). In Ghana, Commey and Dekyem (1995) conducted a survey on childhood anaemia at Korle-Bu Teaching Hospital and found that severe anaemia that is haemoglobin concentration less than 7.0g/ dL was around 71% among children who were referred to the hospital from January to December for haemoglobin check. A baseline study on prevalence and aetiology of anaemia conducted in 1995 found 84% of pre-school children to be anaemic (GHS, 1995). The World Health Organisation's (WHO) global survey on prevalence of anaemia from 1993-2005 also suggests that 76% of pre-school children were anaemic in Ghana (WHO, 2008). Ghana Demographic and Health Survey in 2008 found children under-five to have anaemia prevalence rate of 78% (GSS *et al* 2004; GSS *et al*, 2009). Meanwhile earlier on in the year 2003, Ghana Health Service outlined certain measures to reduce anaemia in children in the country. Some of these measures were iron and folic acid supplementation and anti-malaria prophylaxis for pregnant women, promotion of the use of the insecticide treated bed-nets and six months deworming for children aged 2-5 years. Some of these measures are still on-going, but the prevalence of anaemia in children is still high and has even increased by about 2%between 2003 and 2008 for the entire country with even higher figures at the regional levels. In terms of the spatial distribution of

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prevalence of anaemia in children for the year 2008, anaemia in rural areas and urban areas were 84% and 68% respectively (GSS *et al*, 2009). The Upper West and Upper East had the highest of prevalence rate of anaemia in children of 88% and 89% respectively while Greater Accra recorded 62% (GSS *et al*, 2009). Various studies have linked anaemia to a number of factors, and found that iron deficiency anaemia is a major threat to child and maternal health (GSS *et al*, 2009; Paliakara, 2009). Generally, there have been several studies on anaemia in Ghana, but household characteristics have not been well explored. The major gaps in the study of anaemia in Ghana, therefore, are inadequate explanations of the spatial variations that have occurred in rural-urban areas of Ghana. Furthermore, the reasons for regional differences have also not received much attention. Moreover, household characteristics such as family composition, heads of household, household size, housing and type of households in which children dwell as well as household feeding practices have not been well explored as variables that could be associated with anaemia in children (Bongaarts, 2001; Kennedy and Cogill, 1987; World Bank, 1975). The WHO (2008) is of the view that the role of other factors rather than iron deficiency in the development of anaemia is not well appreciated by public health officials because for a long time anaemia has been confused with iron deficiency anaemia and it has influenced the development of strategies and programmes designed to control the immediate causes of anaemia whereas the myriad of remote causes are left untackled (WHO, 2008). It is on the basis of the problems mentioned above that the current study seeks to find answers to household factors which constitutes the remote causes that are associated with anaemia among children in Ghana.

Conceptual and Theoretical Perspectives

Anaemia in childhood is defined as a haemoglobin (Hb) concentration below established cut-off levels (WHO, 2001; Senn *et al*., 2010). These levels vary depending on the age of the child, and on the laboratory in which the blood sample is tested. Anaemia is a condition characterized by a reduction in the red blood cell count or in the concentration of haemoglobin. Anaemia is not a disease; it is a manifestation of various diseases and pathologic conditions (Sharman, 2000). According to the World Health Organization (2008), children's anaemia levels are classified into three groups based on the level of haemoglobin in their blood and these are mild (haemoglobin concentration between 10.0-10.9 g/dl), moderate (haemoglobin concentration between7.0-9.9 g/dl) and severe (haemoglobin concentration less than 7.0 g/dl). The World Health Organization suggests levels of Hb below which anaemia is said to be present. These levels are haemoglobin concentration <11 g/dL in children aged between 6-59 months and <11.5 g/dL in children aged between 5-11 years and <12 g/dl in older children aged between 12-14 years (WHO, 2008).
Determinant factors of anaemia could be household characteristics such as the number of people in households, heads of households, household income, parents' level of education, place of residence and housing facilities such as access to water and good sanitation. These determinants could have influence on child care and children's health of which anaemia becomes very important and therefore is very fundamental to explore into it (Bongaarts, 2001; Argeseanu, 2004; Cattaneo *et al*., 2007). According to Osorio (2002), child's age, food, place of residence, care, parental education and income as well as other household practices serve as determinant factors of anaemia. Mosley and Chen (1984) adapted the model of Bongaarts (2001), Davis and Blake (1956) for measuring the proximate determinants of fertility, child morbidity and mortality in developing countries. According to the model, proximate determinants directly influence the risk of morbidity and mortality and they form the chain through which socio-economic determinants and environmental conditions affect health and diseases. The framework essentially provides a clear distinction between socio-economic determinants and proximate determinants of child survival in developing countries which could also affect the anaemia status of children in Ghana (dealing with all conditions that can lead to mortality or morbidity of children or otherwise). The proximate determinants according to Mosley and Chen (1984) are maternal factors which include age at birth, parity and birth intervals. The age of a mother can increase a risk factor of both the mother and the child. This may be as a result of old age or below age terms or under aging of a woman which comes with risk factors for mortality (Mosley and Chen, 1984).

These according to Osório (2002) are referred to as biological factors which also include the child's age. It might come from several factors of which anaemia could be vital for both the mother and the baby which is associated with increased risk of morbidity and mortality (Bagchi*,* 2004; Zimmerman & Kraemer, 2007; Strauss & Thomas, 1995). Environmental contamination as one of the proximate determinants includes intensity of household crowding, water contamination, and household food contamination or potential faecal contamination. These indicators could also affect child health especially in the area of diarrhoea and worm infestation which could result in anaemia in children (Boadi & Kuitunen, 2005; Bagchi*,* 2004; Otoo, 2008; Paliakara *et al*, 2009). Nutrient deficiency, in terms of nutrient availability to infant or to the mother during pregnancy and lactation has been identified as a possible factor that could affect child survival (Osório, 2002), Mosley & Chen, 1984). It is very prominent in developing countries which have resulted into over 50% of iron deficiency anaemia in the world as a result of chronic malnutrition and under nutrition (Commey, & Dekyem, 1995; Paliakara *et al*, 2009; Black *et al*, 2003) has found that under nutrition is the underlying cause of 3.5 million child deaths globally leading to 35% of disease burden.

Again, 11% of the total disease burden worldwide is due to maternal and child under nutrition (Black *et al*, 2003). Black *et al*.,(WHO& UNICEF, 2003)have also established that 10 million children die every year globally as a result of malnutrition. Other proximate determinants that could affect children and possibly lead to anaemia are injury and personal illness control in the area of the use of preventive services as immunisations, malaria prophylactics or antenatal care and use of curative measures for specific conditions (Mosley & Chen, 1984). The World Health Organisation and UNICEF in the Africa Malaria Report (Christofides, 2005) found that there are three principal ways by which malaria can lead to death in children; one of the three is chronic repeated infection which contributes to severe anaemia and subsequently leads to death in children(Christofides, 2005). This study adapts the proximate determinant model by Mosley and Chen (1984) to understand various conditions that could lead to anaemia in children in Ghana. Adaptation of this model was necessary because most studies only utilized the proximate determinant model to explain fertility and mortality (Davis and Blake, 1956; Mosley and Chen, 1984; Bongaarts, 2001). This study, therefore, identifies these short falls by identifying socio-demographic characteristics of households and their influence on anaemia of children under-five. Figure 1 articulates the proximate determinants of anaemia adapted from Mosley and Chen (1984). This framework (Figure 1) describes anaemia as a dependent variable in which the socio-demographic/ economic factors which are the independent variables operate through the proximate determinants which in turn influence the risk of a child getting anaemia. Anaemia is a manifestation of pathologic conditions of various diseases and this model is suitable for explaining many health conditions in children.

In some cases the proximate determinants are measured directly whilst some are measured indirectly. For the purpose of this study, the proximate determinants are age of a mother, marital status, and sex of household head. Others are environmental factors such as water sources and sanitation. The socio economic/demographic determinants are classified into three levels. These are individual level, household level and community level factors. The individual level describes individual skills measured by educational levels of parents (both fathers and mothers), health and time. Fathers' education draw a parallel with occupation, and, therefore, with household income and seen for that matter as a strong determinant of income and household assets. This also influences attitudes and preferences in choice of consumption goods including child care.

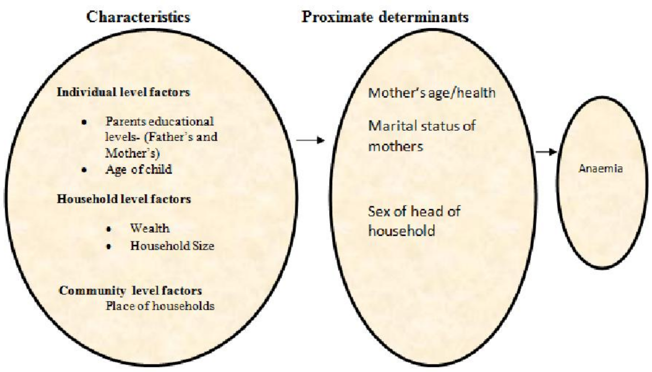

Figure 1. Conceptual framework on the proximate determinants of anaemia

Source: Adapted from Mosley & Chen (1984)

The education of Mother's on the other hand, is utterly different in that their skills and time and health operate directly on proximate determinants because of biological links between the mother and infant during pregnancy and lactation and nutritional status which influence the health of the child that could lead to anaemia. This is because of her responsibility through pregnancy and the care of her child through certain crucial stages of its life. A Mother's educational level can, therefore, affect a child's survival by influencing her choices and increasing her skills in health care practices especially nutrition, preventive care and disease prevention. Mother's time is also required to maintain a healthy child. This is because mothers perform many roles at home such as cooking and bathing children among other things. According to the framework, mother's time could also be diverted for generating income to the disadvantage of the child especially when it comes to issues in complementary feeding. Food preferences could also operate through the proximate determinants leading to anaemia in children. Patterns of dietary intake and food choices are very crucial. These are normally from cultural orientation of people especially food taboos and restrictions are commonly practised during pregnancies, lactations, weaning, and illness.

Household level factors describe income and wealth of households which translate into goods, services, and assets at the household level which influence children health. Water as one of the household level factors is required in both quantity and quality. Water is very essential in that it is used for drinking, cleaning of households, washing and bathing which can prevent exposure to diseases. Other assets measured by household wealth and income are clothing/bedding which prevent the incidence of skin infections and parasitic infections which can prevent anaemia. Other areas are type of flooring in households which prevent diseases or otherwise. Community-level variables have been discussed under place of residence. Ecological setting of a place could determine rainfall, temperature altitude and seasonality. According to the framework, these variables could have a strong influence on child survival by affecting quantity of food produced as well as water and its quality which could lead to poor health in children. The variable could also influence health which is physical infrastructure in the community such as water and sewage, political, health system variables, that is, disease control measures mandated by law to control diseases and others.

MATERIALS AND METHODS

This study examines secondary data from Ghana Demographic and Health Surveys conducted in 2008 in the ten regions of Ghana. The surveys provide accurate information on population and health in all the regions in Ghana. It is also important in epidemiology and public health fields that solely dwell on health of the population rather than the individual. The GDHS is a nationally representative survey of women and men aged 15-49 and 15-59 of households covering sample points throughout Ghana. The 2008 GDHS was implemented in a representative probability sample of more than 12,000 households of which a two staged sample design was used. About 5,829 women as against 4,769 men were successfully interviewed. In half of the households selected for the 2008 GDHS surveys, consenting women aged 15-49 and children aged 6-59 months were tested for anaemia. The protocol for hemoglobin testing was approved by the ICF Macro Institutional Review Board (IRB) in Calverton, Maryland, USA and the Ghana Health Service Ethical Review Committee in Accra, Ghana. Haemoglobin testing is the primary method of anaemia diagnosis. Testing was done, using the HemoCue system. A consent statement was read to the eligible respondent or to the parent. This statement explained the purpose of the test, indicated that the results would be made available as soon as the test was completed, and requested permission for the test to be carried out. In the case of persons whose haemoglobin level was lower than the cut-off point, a referral form was provided to the respondent to be taken to a doctor or a health facility. All the surveys employed household questionnaire and interview guides as instruments. In the households selected for the survey, all women aged 15-49 and all men aged 15-59 were eligible to be interviewed if they were either usual residents of the households or visitors present in the household on the night before the survey. In 2008, a total of 2,117 children out of 5,096 households were selected for anaemia testing. Out of this number, 51.4% constitutes males and 48.6% were females. It can be observed from the survey that males covered were slightly higher than females. From the 2000 Ghana census report, males between 0-4 years and 5-9 years were slightly higher than their female counterparts. For example, males between 0-4 years were 1,399,765 whiles females were 1,389,651. Again, males between 5-9 years were 1,390,652 whiles the females were 1,384,554.

Statistics Data Analysis (STATA) and Statistical Product and Service Solution (SPSS) were employed for the analysis. Descriptive statistic was done to describe the background characteristics in the sample and to check for the variables for any violation of the assumption underlying the statistical techniques employed. Frequency was used in the study. It provided summary statistics of the data. Again, it also provided pre-information concerning the distribution. Logistic regression model was used to analyse the variables and test for the hypotheses. It was considered appropriate for the study because it involved predicting categorical outcomes with two or more categories. It tells about how well a set of predictor variables predicts or explains categorical dependent variables (anaemia or no anaemia). The dependent variable in the analysis was anaemia status of children under-five surveyed by the GDHS. The Anaemia status of children was captured in three categories by GDHS's report namely severe, moderate and mild anaemia. For the purpose of this study, the data was collapsed into categorical, that is, whether a child had anaemia or not. Zero (0) represented no anaemia whilst one (1) represented anaemia in the analysis. This was done because according to WHO (2008), anaemia of any form constitutes a problem to children.

The independent variables in the study were the socio-demographic and economic characteristics of households. Some of the variables were re-coded to suit the objectives of the study. A variable such as, educational level of parents was captured as no education, primary, secondary and higher. Household size was also put into four categories that are 1-5, 6-10, 11-15 and 16-22 members. Place of residence was also classified into urban and rural. Age of children under five was also grouped into three categories which were 1-5, 6-24 and 25-59 months. Other independent variables measured were housing characteristics such as sources of drinking water which was re-grouped into open well, protected well, pipe, surface water and others. Also, household wealth was re-grouped into very poor, poor, and non poor household. The independent variables were categorical since the continuous variables such as age, household size, was re-grouped into categories. These variables were further grouped into individual, household and community level factors in the multivariate results. There were four different modelling which was employed to determine independent variables that were strong in contributing to anaemia as well as the effects of the intermediate variables among children. This was done according to the framework adapted for the study. Model 1, measured the individual level factors in the framework, model 2 measured household level factors, model 3 measured community level factors and model 4 added the proximate determinants to models 1, 2, and 3 to find out the effects of intermediate variables on anaemia. This logistic modelling was informed by the choice of the conceptual framework adapted for the study. The results were reported with the odds ratio output by the model which helps to determine the strength of the individual variables and their relationship with anaemia. The next section presents the results of the study.

RESULTS AND DISCUSSION

The proportion of children with anaemia by age group in months is presented in Table 1. The tabled results shows that a greater number of children (85%) aged 6-24 months were anaemic respectively. The age group of mothers and anaemia status of children are also presented in Table 1. The age group ranges from 15-49 years. The results suggest that majority of the children (89%) whose mothers were aged 15-19 were anaemic. However, for the same years prevalence of anaemia decreased (70%) in children whose mothers were aged 45-49 years in that order. Rural-urban proportion of children with anaemia for both survey years is also presented in Table 1. Previous studies held that more than two-third of sample data were usually anaemic in the rural areas of Ghana, and this number however saw an increased to about 85% in the 2008 survey year. Analysis of the 2008 data reveals that there are lower proportions (68%) of children with anaemia in urban areas as compared to the rural areas. From the study in terms of place of residence, children living in rural areas for both survey years were at a higher risk of getting anaemia compared to children in urban areas.

The proportion of children with anaemia by mother's educational level for 2008 is shown in Table 1. Results indicate that there were larger proportions (83%) of children with anaemia whose mothers had no formal education. The least proportions (54%) of children whose mothers had higher education were less likely to be anaemic in that order. From the table, it can be deduced that mothers who had higher education were less likely to have their children to be anaemic compared to mothers who have never attended school. Father's educational level and anaemia status of children are also illustrated in Table 1. With reference to the table, it is noticed that larger proportions (81%) of the children who were anaemic were from fathers who have never attended school and those with primary education. The least proportions (57%) of them with anaemia were from fathers who had higher level of education. Similar trend is observed, that the majority of the children (89%) were anaemic from fathers with similar levels of education compared to the children from fathers with higher education (62%) being the least proportion. It can be inferred from the Table 1 that father's educational level is very important since a greater proportion of these children whose fathers had lower level of education or have never attended school were at a higher risk of being anaemic. The results on household wealth and its influence on anaemia show (Table 1) that prevalence of anaemia was low (68%) among children from non poor households. It is reckoned from the table that greater proportions (86%) of the children who were anaemic were from very poor households. The proportions (66%) of children with anaemia from non poor homes were lower compared to that of very poor and poor homes.

Table 1. Proportion of children with anaemia by some socio-demographic characteristics

Year of survey	2008
Age in months	
1-5	0.0
6-24	85.1
25-59	74.5
N	2,117
Sex of head of household	
Male	79.6
Female	75.0
Age of mothers	
15-19	89.0
20-24	83.5
25-29	79.0
30-34	74.0
35-39	77.0
40-44	75.7
45-49	75.0
N	2116
Religion	
Catholic	78.4
No religion	86.2
Protestant	77.1
Moslem	80.3
Other Christian	77.1
Pentecost/charis.	75.7
Traditionalist	87.5
Place of residence	
Rural	84.8
Urban	86.2
N	
Ethnicity	2115
Akan	76.2
Ga/Dangme	70.1
Ewe	79.8
Guan	75.9
Mole-Dagbani	81.0
Grussi	86.6
Gruma	91.6
Mande/Housa	82.4
Other	71.6
N	
Father's level of edu.	
No education	83.9
Primary	88.6
Secondary	76.4
Higher	61.9
Don't know	77.2
N	2115
Mother's level of edu.	
No education	83.4
Primary	80.8
Secondary	74.2
Higher	54.0
N	2115
Wealth	
Very poor	86
Poor	81
Non poor	66
N	2117

Source: Computed from GSS, GHS, & ICF Macro., 2009 data set

Logistic regression estimates of determinants of anaemia

This section presents multivariate results of the logistic regression estimates on individual, household and community level factors and their relationship with anaemia among children under-five. The individual level factors explored in the model 1 included child age and parents' educational level. The analysis has shown that there is a significant relationship between age and being anaemic (Appendix A). Having controlled for age group 25-59 months (Appendix A), the results indicated that children aged 6-24 months were more than twice likely to be anaemic (OR 2.10, $p<0.000$) compared to children aged 25-59 months. The effects in Model 4, had decreased marginally, but was still strong and positive (OR 1.98, $p<0.000$). Studies have revealed that mothers start introducing complementary feeding from age 4 and 6 months, which affects children nutrient level (WHO, 2008). At this age, care need to be taken because most children start to develop anaemia at this age because of reduction of nutrients in the diet given to children. Other similar reasons have been put forward that children are barely anaemic at birth. However when mothers start to introduce complementary foods anaemia develops (WHO, 2001; Osório *et al*., 2003; Paliakara *et al*., 2009; WHO, 2008).

Other researchers have proven that young children in this age group require high dietary iron, but normally these children have limited access to iron containing food which could lead to anaemia in children. According to WHO (1998) and UNICEF (1998), the human milk is high in bioavailability of iron approximately 50%. However this bioavailability can decrease by 80% when complementary food is being introduced and this could lead to the genesis of anaemia. These findings among other things point to the fact that complimentary feeding with high iron diet is not well carried out in Ghana among under-five children. Moving on, the effects of both fathers' and mothers' educational levels on anaemia were tested. It came to light that children of fathers with no education were about 75% (OR 1.75, $p<0.001$) more likely to be anaemic. In Model 4, however, the odds of children with anaemia decreased to about 29% (OR1.29). Again, the odds of anaemia increased more than twice (OR 2.23, $p<0.002$) in children whose fathers had primary education compared to fathers with higher education (Appendix A).

From the literature, fathers' educational levels relate strongly to occupation and household income which will eventually affect health outcome (Mosley & Chen, 1984). Ball and Moselle (2007) also found in their studies that in Canada, fathers' effort to generate income for the family affectsa family environment in the area of food, housing among others which contribute to nutrition deficits, infections and injuries which could be of immense benefit to children. The logistic results on mother's educational level dummy imply that mothers with low level of education were more likely to have their children to be anaemic compared to mothers with higher education. It is observed in model 1 that children of mothers with no education were also more than twice likely to be anaemic (OR 2.27, $p<0.033$) compared to mothers with higher education. In the fourth model, the effects of the intermediate variables had decreased the child's likelihood of getting anaemia with parents who had never been to school to (OR

1.29) and this was not significant as well. Children of mothers with primary level of education for the same year also were more than twice likely to be anaemic (OR 2.12, $p<0.02$) compared to mothers with higher level of education. The odds of a child likelihood to be anaemic decreased in Model 4 (OR 1.68, $p<0.043$). It was observed that mothers' level of education including no education and primary were affected by the addition of the proximate determinants and other variables and this made the variables not significant in the fourth model compared to fathers. These findings confirm the assertions of Kennedy and Cogill (1987) who remarked that mothers' educational level translate into better health of their children. It shows that mothers are care-givers in various households and their educational level might bea factor in determining anaemia in children. Chen (2004) finds that a father's education as well could be essential because fathers are more likely to have higher education than mothers in developing countries. In Pakistan as a case in point, Aslam and Kingdon (2010) revealed that because of fathers' high level of education than mothers, fathers' education could be an important determinant of health which will definitely be of an advantage to children.

These reasons could explain why mothers' dummies for educational levels have not been significant inmodel 4 since fathers are highly educated than mothers in Ghana (World Economic Forum, 2010). Again, fathers are seen as household heads and are responsible for providing money for food so fathers with higher educational level could translate into income and this could affect the health of children. Supporting this from the framework adapted, fathers education is strongly correlated with occupation and therefore translates into income. Father's educational level has been explained as translating into household assets and other commodities which translate into better living conditions. Finally, it is also significant to note that fathers' education affects attitudes, and thus brings preferences in the choice of consumption goods, including child care practices, and these conditions could explain strongly why fathers' education is a strong determinant factor for anaemia in children.

In Model 2, results on types of flooring material as one of the household level variables and prevalence of anaemia demonstrate a significant relationship (Appendix A). For instance, the results show that, children from cemented households were less likely to be anaemic (OR -0.79, $p<0.041$) compared to children from mud households. This denotes that there is a significant reduction of anaemia in children who were in cement households. There was a negative effect for children in cement households in Model 4 as well but was not significant for both years. According to World Economic Forum (2010), replacing dirt floors with cement ones could reduce anaemia by 81%. Also, Cattaneo *et al.*(2007) posit that replacing mud floors in Mexico with cement floors improve child health in the area of preventing parasitic infestation which are associated with diarrhoea, micro nutrient malnutrition that lead to anaemia. From the findings, it can be deduced that replacing mud floors to cement ones in Ghana could be one of the important factors in reducing anaemia. The results from the logistic regression estimate on household wealth indicate a significant relationship between wealth and anaemia status of children. The findings in Appendix A showed that children from non poor households were less likely to be anaemic (OR -0.74, $p<0.05$) compared to those from very poor households. This indicates that anaemia decreases with increasing household wealth. A comparism of the data to some related studies however showed that the effect is still notable and significant at 1% in Model 4, indicating a strong effect of wealth on anaemia. United Nations Children's Fund (2009) noted that children from income-poor families have far higher rates of under-five mortality. A poor household may lack food rich in iron which many studies reveal are the major contributing factors to anaemia (Ministry of Health, 2007). More so, poor households may not be able to afford better residential areas, hence, the poor are normally found in areas with problems of sanitation which normally lead to several diseases of which anaemia may be common (MOH, 2007). The logistic regression results on household size and children with anaemia showed that children who were in the households with members numbering between 6-10 were about 22% (OR 1.22) more likely to be anaemic compared to households with members numbering 1-5. However, children from household with members 16-22 were less likely to be anaemic.

Community level factor in this study was place of residence, which was presented in Model 3.The results from the logistic regression estimates on both place of residence and de facto place of residence show that children in urban areas were less likely to be anaemic (OR -0.56, $p<0.004$) for the data compared to their counterparts in rural areas in this respect. The effects of the proximate variables and other variables in Model 4 decreased the odds for urban variables. However, the odds for urban variable were strong and significant in Model 4, which signified the strong effects of urban variable on anaemia status of children. Studies such as Fotso (2007), Sahn and Stifel (2003) and Smith *et al*. (2005) have revealed that urban children are better nourished and are less likely to suffer malnutrition than rural children. Since one of the major contributing factors to anaemia is nutrition related, that is iron deficiency; it could be clear from this point that malnutrition could be a reason why rural children have a higher proportion of anaemia than urban children. Other studies have also revealed that urban children face a lower risk of dying before their first or fifth birth day.

United Nations Children's Fund (2009) also maintains that in all developing regions and every sphere of Primary Health Care and education, children living in urban areas are more likely to have access to essential services and commodities than rural areas. For example, UNICEF as well finds that in the area of environmental health, in 2006 only 45% of the world rural population had access to basic sanitation facilities compared to 79% in urban areas. In Ghana, the Ministry of Health had also highlighted on inequalities in access to health care which puts poor children at disadvantage position and this could lead to poor health conditions (MOH, 2007). Results from the current investigation have further supported other studies by Krieger (2001), Davis and Blake (1956) and WHO (2006) where inequalities in access to health care hadbeen diagnosed as one of the reasons affecting the poor. The proximate determinants for the purpose of this study are mother's age, sex of household head and marital status of mothers which were included in the model (4) to see their effects directly or indirectly on prevalence of anaemia among children in Ghana. The results on the relationship between mother's age and anaemia status of children indicate that mothers who were aged 20 years and above were less likely to have their children to be anaemic compared with mothers less than 20 years. Apart from biological reasons for mothers' age and child health, age comes with experience in caring practices which demand an adequate amount of time for babies. Hence, mothers aged 15-19 years can be said to be young to provide that time and care since most of them are adolescent and lack resources. These findings are consistent with the reports of GDHS that anaemia was high in children with young mothers. Furthermore, Olaniyan (2002) asserts that mother's age in Nigeria is very important when it comes to child health status. He finds in his study that mother's age was significant in rural areas for growth pattern of children, but was not significant in urban areas. According to Florida State University Center for Prevention and Early Intervention Policy (2005), children of adolescents are more likely to be 50% low-birth weight babies and are likely to be born prematurely. They also reveal that daughters of adolescent mothers are more susceptible to economic dependence and less likely to escape poverty. Again, children born to teen mothers often do not have an even start in life. They normally grow up in a poor environment which affects their health of which they cannot escape from anaemia. Looking at the conceptual framework adapted (Figure 1) both the child's and mother's age could act as intermediate variables as well as socio-demographic characteristics influencing anaemia in children.

The findings from the estimates on the relationship between marital status and prevalence of anaemia indicate a mixed result. The results (Appendix A) showed that there was a positive relationship between mothers who were single with anaemia of their children, but the coefficient of the variable was not significant. The dummy for marital status was positive, but was not significant. It could mean that currently being a single mother might not necessarily affect a child health in terms of anaemia since single mothers could provide alternative to child care. One of the important reasons why people marry is to support each other socially and financially; hence, parents who are married and have caring husbands could benefit from their support which could improve child health at home (Mosley & Chen,1984;Chen, 2004). The marital status of a mother of a child has implications for the maintenance of the child by the father (Abu, 1983). Badasu(2004) and Oppong(1997)maintained that children who are co-resident with both parents have their material needs more adequately provided while those with mothers only are normally neglected by their fathers.

Conclusion and policy recommendations

This study looks at some socio-demographic variables that serve as determinants of anaemia among under-five children in Ghana using a data from Ghana demographic survey of 2008. From the results it can be concluded that there was a significant notable relationship between children age and mother's age with anaemia. Children aged 6-24 months were positively related with anaemia and contribute significantly more than any of the variables as shown in the odds ratio output. These show that child and mothers age are determinant factors of anaemia among children in Ghana. A notable finding was the strong relationship between father's educational level and prevalence of anaemia among children rather than mothers. This also means that father's educational level is crucial in determinant of anaemia as mothers. There was also a significant relationship between mother's marital status and anaemia of children in Ghana. Mothers who were married were less likely to have their children to be anaemic and this also indicates that marital status could be a determinant factor of anaemia in Ghana. Anaemia prevalence in children increases as household size also increases. This implies that the number of people in households could serve as a determinant factor of anaemia in children. Wealth status of households had a strong linkage with anaemia among children in Ghana as well. For instance, children from non poor household were less likely to be anaemic. This implies that wealth status of household serve as a determinant factor of anaemia. Place of residence indicates a significant notable effect on prevalence of anaemia among children in Ghana. Prevalence of anaemia in urban areas was low compared to rural areas. It can therefore be concluded that place of residence is a strong determinant factor of anaemia in Ghana.

Finally, it was observed from the results that a range of factors such as socio-demographic factors like: age of children and mothers, parents level of education, marital status of mothers, household wealth, household size, sources of water and place of residents were important determinant factors of anaemia among children in Ghana. However, these determinant factors change overtime and some operate through the intermediate variables leading to anaemia. Again, since anaemia is not a disease, but manifestation of various diseases and pathologic conditions, a multi level approach involving all sectors need to be designed frequently to reduce the level of prevalence of anaemia among under-five children in Ghana. On specific policy implication, it is recommended that, GHS should provide appropriate education on complementary feeding for mothers who have under-five children especially children aged 6-24 months. MOH, GHS and other organisations such as UNICEF and WHO should design programmes in anaemia prevention targeting children and their mothers in rural sectors as well as small cities in order to reduce anaemia in Ghana.

Education on anaemia and child care by MOH and GHS should not target only mothers, but fathers as well, especially those with low level of education. Ministry of Health and Ghana Health Service should provide education on good health practices and include issues of religion as a factor in contributing to anaemia. Government interventions towards reducing poverty should target under-five children in poor households. This could be done by raising wealth status of these households by direct aid, charity or helping them in income generating activities. This could directly and or indirectly reduce prevalence of anaemia in children since the finding shows that prevalence of anaemia among children was very high in poor households. Government should provide assistance to young mothers aged 15-19 in feeding and other caring practices of their children who are under-five. The Department of Social Welfare could identify mothers in these age groups and assist them. This is because children under-five of these mothers were more likely to be anaemic from the findings. UNICEF and WHO should identify children under-five whose parents are not married and give them assistance in caring for their children at weaning stages. This could be done by providing them with baby friendly food and creating avenue for them to have free medical care. Ghana Health

Service should educate parents to cover floors that are made with mud in order to prevent parasitic infection which lead to anaemia among under-five children in Ghana. Mothers should be educated by GHS to boil water before use especially if the water is sourced from surface water or open well.

REFERENCES

World Health Organization-WHO 2001. *Iron deficiency anaemia: Assessment, prevention, and control.* A guide for programme managers. Geneva: World Health Organization.

Senn, N., Maraga, S., Sie A, Rogerson, S.J., Reeder J.C., *et al*., 2010. Population hemoglobin mean and anemia prevalence in Papua New Guinea: *New Metrics for Defining Malaria Endemicity? PLoS ONE, 5* (2), 9375.doi:10.1371/journal.pone.0009375

Sharman, A. 2000. *Anaemia testing in population-based surveys*: General information and guidelines for country monitors and program managers. Calverton, Maryland USA: ORC Macro.

World Health Organization 2008. Center for disease control and prevention. de Benoist B, McLean. E, Egli I, Cogswell M, (Eds.) *Worldwide prevalence of anaemia 1993–2005.* Geneva: World Health Organisation.

Cattaneo, M., Galiani, S., Gertler J., Martinez, S., & Titiunik, J. 2007. *Housing, health and happiness*: World Bank Policy Research Working Paper 4214, April 2007.

Argeseanu, S. 2004. Risks, amenities and child mortality in rural south Africa. *In African Population Studies*, *19*(1), 13-33.

Bongaarts, J. 2001. *Household size and composition in the developing world.* Policy Research Division: Population Council.

Osório, M.M., 2002. Determinant factors of anaemia in children. *Jornal de Pediatria* (Rio J). *4* (78), 269-278.

Ghana Statistical Service (GSS), Ghana Health Service (GHS) and ICF Macro 2009. *Ghana Demographic and Health Survey 2008.* Accra Ghana: GSS,GHS and ICF Macro.

Ministry of Health (MOH), 2007. Creating health through wealth. Retrieved on 15th January, 2010 from http//: www.moh-ghana.org

Commey, J.O., & Dekyem, P. 1995. Childhood deaths from anaemia in Accra; Department of child Health, University of Ghana Medical School. *West Affr. J. Med*, *14* (2), 101-4.

Ghana Health Service (GHS). 1995. N*ational anaemia prevalence survey. Accra, ghana:* Nutrition unit: Ghana health services.

Ghana Statistical Service (GSS), Ghana Health Service (GHS) and ICF Macro 2004. *Ghana Demographic and Health Survey 2003.* Accra Ghana: GSS, GHS and ICF Macro.

Paliakara, N., Degomme O., & Guha-Sapir, D. 2009. *The complex emergency database* (CE-DAT) Centre for research on the Epidemiology of Disasters (CRED), Université catholique de Louvain Brussels: Belgium.

Kennedy, E., & Cogill, B. 1987. *Income and nutrition effect of commercialization of agriculture in South-western Kenya.* Washington DC: International Food Policy Research Institute.

World Bank 1975. *Income inequality among rural households in rural Nigeria.* Retrieved from http://www.sarpn.org on 20th May, 2011

Mosley, W.H., & Chen, L.C. 1984. An analytic framework for the study of child survival in developing countries. *Population and Development Review,* (10), 25-45.

Davis, K., & Blake, J. 1956. Social structure and fertility: An analytic framework. *Economic Development and Cultural Change. 4* (3), 211-235.

World Health Organization (WHO). United Nations Children's Fund (UNICEF), & United

Nations University (UNU) 2001. *Iron deficiency anaemia: Assessment, prevention, and control: A guide for programme Managers.* Geneva, Switzerland: WHO.

Bagchi, K. 2004. Iron deficiency anemia – an old enemy. *Eastern Mediterranean Health Journal, 10* (6), 754 – 760.

Zimmerman, M., & Kraemer, K. 2007. Nutritional anaemia: *Sight and Life Press, 3* (906412), 33-34.

Strauss, J., & Thomas, D. 1995. Human resources: Empirical modelling of Household and family Decisions. In J. Behram & T. N. Srinivasan (Eds.), *Handbook of Development Economics*, (pp.1883-2023). Amsterdam: Elsevier Science.

Boadi, K.O., & Kuitunen, M. 2005. Childhood diarrheal morbidity in the Accra metropolitan area, Ghana: socio-economic, environmental and behavioral risk determinants. *Journal of Health and Population in Developing Countries*, *3* (1),13.

Otoo, G.E. 2008. *Nutritional status of Ghanaian children* (Power Point). Retrieved on February, 12th 2011 from www.wishh.org/workshops/intl/ghana/ghana08/otoo08.pdf

Black, R. E., Morris, S.S., & Bryce, J. 2003. Where and why are 10 million children dying every year? *Lancet,361* (9376), 2226–2234.

World Health Organisation & UNICEF 2003. *The Africa malaria report 2003.*Geneva, NewYork: World Health Organization & United Nations Children Fund.

Christofides, A. 2005. Iron deficiency anaemia among children: Addressing a global public health problem within a Canadian context. *Paediatr Child Health,10* (10), 597-601

World Health Organisation 2003. *Global strategy for infant and young child feeding practices*. Geneva: WHO.

Osório, M.M., Lira, P.I.C., & Batista-Filho, M. 2001. Prevalence of anaemiain children 6-59 months old in the state of Pernambuco, Brazil. *Salud Publica/Pan Am J Public Health 10* (2), 101-107.

World Health Organization & UNICEF 1998. *Complementary feeding of young children in* developing *countries: A review of current scientific knowledge.* Geneva: WHO.

Ball, J., & Moselle, K. 2007. *Fathers' contributions to children's well-being* Retrieved on17th October, 2010 from www.fira.ca/cms/documents/123/PH_FI_Report_brief.pdf

Chen, E. (2004). Why socioeconomic status affect the health of children: A psychosocial perspective. *Current Directions in Psychological Science, 13* (3), 112-115.

Aslam, M., & Kingdon, G. 2010. *Parental education and child health understanding the pathways of impact in Pakistan.* Retrievedfromwww.csae.ox.ac.uk/workingpapers/pdfs/2010-16text.pdfon 15th January, 2011

Ghana Statistical Service (GSS). 2008, *Ghana living standards survey – report of the fifth round* (GLSS 5), Accra: Ghana.

World Economic Forum 2010. *Housing for all, knowledge cards*: Retrieved from http://www.un.org/en/documents/udhr/ on 12th January, 2011.

Cattaneo, M., Galiani, S., Gertler J., Martinez, S., & Titiunik, J. 2007. *Housing, health and happiness*: World Bank Policy Research Working Paper 4214, April 2007.

United Nations Children's Fund 2009. *State of the World's Children 2010: Celebrating 20 years of the Convention on the Right of the Child.* UNICEF: New York.

Fotso, J-C. 2007. Urban-rural differentials in child malnutrition: Trends and socioeconomic correlates in sub-saharan Africa. *Health and Place*, (13), 205- 223.

Sahn, D., & Stifel, D. 2003. "Urban-rural inequality in living standards in Africa." *Journal of African Economies, 12* (4), 564-597.

Smith, L., Ruel, M., & Ndiaye, A. 2005. Why is child malnutrition lower in Urban than in rural areas? Evidence from 36 developing countries. *World Development*, *33* (8), 1285-1305.

Krieger, N. 2001. *Theories for social epidemiology in the 21st century: An ecosocial perspective. Epidemiologic Reviews, 30* (4), 668-677.

World Health Organisation 2006. *Sickle-cell anaemia* Retrieved from http://www.who.int/gb/ebwha/pdf_files/WHA59/A599-en.pdf on 20th January, 2011.

Olaniyan, O. 2002. *The effects of household resources and community factors on child health*: *Evidence from Nigeri*a. Paper prepared for presentation at the CSAE Conference on Understanding Poverty and Growth in Sub- Saharan Africa. Held at St Catherine's College: Oxford.

Florida State University Centre for Prevention & Early Intervention Policy 2005. *The children of teen parents: Health of infants born to teenage mothers.* Retrieved on 15th December, 2010 from www.cpeip.fsu.edu/resource Files/resourceFile_78.pdf

Abu, K. 1983. The separateness of spouses: Conjugal resources in an Ashanti town. In C. Oppong (Ed.), *Female and Male in West Africa.* (pp.156-68). London: George Allen & Unwin.

Badasu, D.M. 2004. Child care among Ewe migrants in Accra: Cases of crisis. *Institute of African Studies Research Review.* New Series Supplement (16), 17- 37.

Oppong, C. 1997. African family systems and socio-economic crisis. In A. Adepoju (Ed), *Family, population and development in Africa* (pp.158-82). London: Zed.

Appendix A

Logistic regression estimates of determinants of anaemia (2008)

Anaemia	Model 1	Model 2	Model 3	Model 4
Indivividual level				
Factors				
Age 25-59 Months (ref)				
Age 6-24 Months	2.10***			1.98***
Mother's occupation				
0= otherwise				
1= if working	1.00			-0.97
Father's lev of edu				
Higher (ref)				
No education	1.75***			1.29
Primary	2.23***			1.68**
Secondary	1.16			1.10
Mother's edu level				
Higher (ref)				
No education	2.27***			1.33
Primary	2.12**			1.30
Secondary	1.50			1.16
Religion				
Catholic (ref)				
Traditional	1.33			1.53
Moslem	1.23			1.27
Other christian	0.99			0.93
Pentecost chris	0.83			0.61
Protestant	0.94			1.90
Household level factors		(M2)		
Floor = 1 if cement		-0.71**		-0.79
0 = otherwise				
Wealth				
Very poor (ref)				
Poor		1.54		1.18
Non poor		-0.74**		-0.83
Household size				
1-5 members (ref)				
6-10 members		1.22*		1.22
11-15 members		1.18		0.98
16-22 members		0.82		0.73
Sources of water				
Protected well (ref)				
Open well		2.16***		1.27
Surface water		2.15***		1.37
Pipe		1.21		1.30
Community level factors			(M3)	
Place of residence				
0=otherwise				
1= urban			-0.56***	0.54***

…..Continue

De facto place of resident		
Large cities (ref)		
Small cities	1.80**	1.80**
Towns	1.69**	1.46
Country side	1.98**	1.44
Regions		
Greater Accra (ref)		
Western	1.52	1.41
Central	1.52	1.31
Volta	-0.90	0.79
Eastern	0.76	0.62
Ashanti	1.35	1.32
Brong Ahafo	1.10	0.94
Northern	1.45	0.89
Upper West	1.59	1.53
Upper East	1.66*	1.53
Proximate determinats		
Sex of household head		
0= otherwise		
1= if female		0.93
Marital status of mother		
Married (ref)		
Never married		0.98
Age of mothers		
Age<=19 (ref)		-0.53
Age 20-24		-0.53
Age 25-29		-0.52
Age 30-34		-0.53
Age 35-39		-0.40**
Age 40-44		-0.44
Age 45-49		-0.44

Source: computed from GSS, GHS and ICF Macro., 2009 data set

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