Decomposing Wealth-Based Inequalities in Under-Five Mortality in West Africa

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Abstract

Background: This study aimed to analysis the inequalities of mortality of children under 5 years in West Africa by examining the determinants and contributing factors to the overall inequality concentration in these countries.

Method: Data used came from the DHS surveys conducted in the six countries in West Africa: Burkina Faso (2010), Benin (2006), Cote d'Ivoire (2011), Ghana (2008), Mali (2006), Nigeria (2008) and Niger (2012). The concentration index (CI) and Generalized Linear Model (GLM) with logit link were used to access inequality.

Results: The results show that in all countries, the poorest Q1 have the highest proportions of deaths: Nigeria (31.4%), Cote d'Ivoire (30.4%) and Ghana (36.4%), over 30% of deaths of children under 5 years are among the children of the poorest (Q1) and the absolute differences of proportions Q1-Q5 are more than 20 points (25.8 in Ghana and 23.6 in Nigeria). The contributing factors of inequalities of child mortality were birth order, maternal age, parity and household size. Our findings also showed that the intensity of inequality varies from one country to another.

Conclusion: The most important conclusion of this study is to reduce mortality in children under 5 years, it is needed to reduce economic and social inequalities and improve the country's economic and social condition. There is a need for monitoring and assessment inequalities by leading causes of death and morbidity among children in the region in order to advance in understanding the gaps and finding a way to reduce them in West Africa countries.

Keywords: Concentration index Infant mortality, Child mortality, Under five mortality, Family planning

Introduction

The Millennium Development Goals (MDGs) are the world’s biggest promise; that is a global agreement to reduce poverty and human deprivation at historically unprecedented rates through collaborative action (1). Of its many goals, the fourth goal (MDG 4) specifically calls on the international community to reduce mortality in children under 5 (U5) by two thirds between 1990 and 2015 (1). Therefore, the health of children under-five years in general and mortality in particular are a major priority for developing countries. Recent studies indicate that under-five mortality has decreased much during these last decades both in developed and developing countries (2–5). But the fourth MDG goal will not be met by 2015 in many sub-Saharan countries in Africa in the light of progress made (6). Despite the fall in the regional and global child mortality rate, deaths remain alarmingly concentrated in the poorest regions of the world and most notably, sub-Saharan Africa has the highest regional rate of child mortality amongst under-fives. One child out of nine dies before their fifth birthday(5). Similarly, inequalities exist and remain between countries, within each country, between different sub-groups and socio-economic groups (7–12), between place of residence (13,14), between ethnicity (12,15,16), between parental characteristics (8) and children (11). Socio-economic inequalities in childhood mortality are a major public health problem in develop-
ing countries. Childhood mortality is systematically and considerably higher among lower socioeconomic groups within countries (2). Reducing these inequalities by improving child survival up to the level of more advantaged groups within countries would substantially improve population health (2). Specific attention is being devoted into the research on child health inequalities in developing countries (2,13,15,17–28). Some of these researches focused on sub-Saharan Africa by conducting regional and multi-country studies on this topic. But in the case of West Africa to be specific, the literature consulted indicates that research remains low even where this part of Africa has the highest rates of under-five mortality in the world and these countries are among the world's poorest countries(29). What are the determinants of inequalities in mortality among under-five in West Africa? Are there some variations between and within countries?

The objective of this study is to analyze the inequalities of mortality of children under 5 years in West Africa by examining the determinants and contributing factors to the overall inequality concentration in these countries.

**Study Design**

Previous research’ results found several factors that explain child health inequalities in developing countries. These factors are related to: 1) individual’s characteristics of parents and children; 2) the living conditions of households; 3) the geographical factors and; 4) national policies and reforms especially in the health sector.

Prior research found that a mother’s characteristics such as her education, age during child delivery, parity, food habits and health status could influence the survival of the child(3,15,30–32). Mother’s education level was found in the literature to be strongly associated with child survival and was a determinant factor of inequalities in child health in sub-Saharan Africa(8,33).

Houweling and Kunst (2) argued that maternal education is thought to exert its influence through increased status and decision making power of mothers within the household, increased willingness and ability to travel outside the community, more timely use of health care, greater negotiating power with health care providers, increased knowledge, skills and identification with modern health systems and responsiveness to new ideas. Maternal education is estimated to be accounted for by its association with household wealth, and probably the associated better living conditions and ability to pay for health services.

Socioeconomic environment of households was also found as an important factor of child health inequalities. In fact, the living conditions of households have a direct influence on children's health through the quality of drinking water and hygiene in the household, the use of health services, food and health practices, fashion life (2,34,35). The poverty level of the household(25,35–37), size and household composition (31), the gender of the head of the households(34) have an impact on child mortality.

With regard to community factors, research results show that the contextual effects have an influence on children's health. Indeed, the availability and access to health centers, the availability of qualified staff are often lacking in rural and poor areas thus creating favorable factors to population health inequalities (2,9,35,38). Good hygiene practices are relatively likely to live in remote places, far from health centers thus making accessibility very low in case of health problem(36). Several studies examine the effect of the type of residence (urban/rural) on childhood mortality inequalities(13,14,16,30,34). These studies showed that the location of residence (urban vs rural) had a significant influence on the child survival and so residing in rural areas increased the probability of a child dying before the fifth birthday. Houweling and Kunst (2) study showed that the country level, several factors can impact on the magnitude of mortality inequalities through multiple pathways. Indeed, these authors showed that policies

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at the country level can increase or decrease the inequalities between social groups and influence health policy for the poor. West Africa is one of the poorest parts of the world where health indicators are still poorly reported. Under-five mortality remains high in the region and MDG’s fifth (5th) goal will not be met in many West African countries. Common causes of child mortality and morbidity include diarrhea, acute respiratory infections, measles, and malaria. Studies have shown that many children in Nigeria mainly die from malaria, diarrhea, neonatal tetanus, tuberculosis, whooping cough and broncho-pneumonia (39).

Materials and Methods

We used data from Demographic and Health Surveys (DHS) run in six countries in West Africa including Burkina Faso (DHS, 2010), Benin (DHS, 2006), Cote d’Ivoire (DHS, 2011), Ghana (DHS, 2008), Mali (DHS, 2006), Nigeria (DHS, 2008) and Niger (DHS, 2012).

Data sharing statement Data available for public through internet http://www.measuredhs.com

The outcome variable used was the risk of under-five death (0–59 months), which is defined as the probability of dying between birth and the fifth birthday. Variable socioeconomic status built from household assets is used as the main variable for measuring inequalities in mortality.

Selected variables
Child’s sex: Male and Female
Birth order: 1st birth, 2nd-6th birth and 7th & +
Mother's age: 15-19, 20-24, 25-29, 30-34, 35-39, 40-44 and 45-49
Mother's Occupation: Not working, skilled manual and other occupation
Mother's education: No education, Primary, Secondary
Parity: 1-3, 4-6, 7 & +
Father's occupation: Agriculture, Sales, Skilled Manual and Other Occupation
Father's education: No education, Primary, Secondary, Higher and DK
Household's size: 1-3, 4-6, 7 & +

Household head's sex: Male and Female
Location of residence: Urban and Rural
Wealth index: Q1 (Poorest), Q2 Poorer, Q3 Middle Q4 Rich and Q5 Richest

The socio-economic variable was categorized into 5 categories: Q1 being the Poorest, Q2, Q3, Q4 and Q5 as the Richest. The independent variables included: sex of the child, birth order (1st, 2-6th, 7th and above), the mother’s age at delivery (15-19), parity (1-3, 4-6, 7 and above), educational level (no education, primary, secondary and high) and occupation (not working, agriculture, sale, manual, other occupation) of the mother, educational level (no education, primary, secondary, highest and do not know (DK) and the occupation of the father (agriculture, skilled manual, other occupation), household size (1-3, 4-6, 7 and above), sex of household head and the middle of residence (urban vs. rural).

Statistical analysis
The concentration index (CI) is employed in this paper to measure under 5 mortality inequalities. CI quantifies the degree of income-related inequality in a health variable, and is becoming a standard tool for the measurement of income-related health inequality (Liu, Gao & Yan, 2014).

Detailed information about the methodological tools used is presented in some publications (37,41–44).

\[ C = \frac{2}{\eta \mu} \left( \sum_{i=1}^{n} h_i R_i \right) - 1 \]

Where \( h_i \) is the variable of interest for the ith person; \( \mu \) is the mean or proportion of \( h \times n \) is the number of persons; and if the \( n \) individuals are ranked according to their socioeconomic status, beginning with the most disadvantaged, then \( R_i \) is their relative rank, \( i \cdot 0.5/n. \) When there is no inequality (or when inequality is balanced and opposite for equal fractions of the income-ranked population), the concentration index equals 0. If the variable of interest is concentrated at a lower (or higher) socioeconomic level, the concentration index becomes negative (or positive).
Generalized Linear Model (GLM) specifying binomial distribution and identity link was used to perform multivariate analysis. The coefficients from GLM were used subsequently to decomposing and computing the contribution of independent variable to the concentration index. The method used is detailed somewhere (41).

Results

Table 1 presents the proportions of deaths by poverty status and country. The results show that in all countries, the poorest Q1 have the highest proportions of deaths: Nigeria (31.4%), Cote d’Ivoire (30.4%) and Ghana (36.4%), over 30% of deaths of children under 5 years are among the children of the poorest (Q1) and the absolute differences of proportions Q1-Q5 are more than 20 points (25.8 in Ghana, 23.6 in Nigeria and Cote d’Ivoire has 19.3). For Burkina Faso (14.5), Benin (15.7) and Mali (12), the absolute differences of the proportions of deaths of children under-five years between the poorest and the richest is more than 10 points. Niger appears to have the low gaps between poorest and richest with an absolute difference of less than 1 (0.7). The overall concentration index was -0.12 for Burkina Faso in 2010, -0.07 for both Benin in 2006 and for Cote d’Ivoire in 2011. The concentration index was -0.03 for Ghana in 2008 and -0.10 for Mali in 2006. It was -0.12 and -0.07 respectively for Nigeria in 2008 and Niger in 2012.

In all the countries concerned by this study, the value of the concentration index is negative and thus shows that mortality is concentrated among children from poor households (Q1=Poorest) than among children of wealthy households (Q5=Richest). Inequalities in mortality are higher in Burkina Faso, Nigeria and Mali whose concentration index was lower than -0.10. Inequalities in child mortality are less pronounced in Ghana, Niger and Cote d’Ivoire than elsewhere.

Figure 1 presents the proportions of deaths of children under-five years by quintile of socioeconomic and by country. The results of the graph show that the poorest are those with the highest death proportions.

Factors associated with child mortality

Table 2 shows the proportions of deaths for each determinant factor associated with child mortality. The results on factors associated with the mortality of children under the age of 5 years for each country are presented in Table 3. Birth order was significant in all countries in the study. Children with 7th and above were more likely to die before their fifth year than the first child. The variable sex of the child is significant for Nigeria and Cote d’Ivoire and the results showed that girls had less probability to die before their fifth birthday than boys.

Table 1: Proportion of deaths in children under 5 years by socioeconomic quintile and country

| Country       | Q1(Poorest) | Q2 | Q3 | Q4 | Q5(Richest) | Q5-Q1 | (Q5-Q1)/Q1 | C(95%CI) | N1   | N2   |
|---------------|-------------|----|----|----|-------------|-------|------------|---------|------|------|
| Benin         | 25.56       | 22.47 | 23.91 | 18.23 | 9.83        | 15.72 | -0.62      | -0.07(-0.10;-0.04) | 16075 | 1393 |
| Cote d'Ivoire | 30.39       | 25.41 | 19.61 | 13.54 | 11.05       | 19.34 | -0.64      | -0.07(-0.14;-0.01) | 3644  | 362  |
| Ghana         | 36.36       | 17.68 | 19.19 | 16.16 | 10.61       | 25.76 | -0.71      | -0.03(-0.11;0.05)  | 2992  | 198  |
| Mali          | 22.77       | 24.43 | 21.82 | 20.21 | 10.77       | 11.99 | -0.53      | -0.10(-0.13;-0.08) | 14238 | 1801 |
| Nigeria       | 31.38       | 27.39 | 19.84 | 13.66 | 7.74        | 23.64 | -0.75      | -0.12(-0.14;-0.10) | 28655 | 3206 |
| Niger         | 17.36       | 22.7 | 20.5 | 22.8 | 16.63       | 0.73  | -0.04      | -0.07(-0.10;-0.03) | 12358 | 956  |

N1=Number of births; N2=Number of deaths; Source: data from Demographic and Health Surveys (DHS) run in six countries in West Africa including Burkina Faso (DHS, 2010), Benin (DHS, 2006), Cote d’Ivoire (DHS, 2011), Ghana (DHS, 2008), Mali (DHS, 2006), Nigeria (DHS, 2008) and Niger (DHS, 2012). Q1Poorest; Q2 Poorer; Q3 Middle; Q4 Richer; Q5 Richest

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The demographic characteristics of the mother such as age and parity have proved significant in the countries in the study and it appeared that the children of elderly mothers and mothers with high parity are more likely to die before their fifth birthday than those of the young mothers (15 and 19 years) who have low parity. The mother’s occupation is only significant in Mali and Cote d’Ivoire. Contrary to our expectations, the mother’s education level was not significant in some countries concerned as observed in the analysis. In Mali and Nigeria, the mother’s education was significantly associated with child mortality of under 5 years.

According to the father’s characteristics, results showed that the father’s occupation is significantly associated with under-five mortality in Benin and Nigeria, while father’s educational level is significant in Ghana, Mali and Niger. Thus, children whose fathers are educated had lower probability of dying than those whose fathers were not going to school.

Household size seemed to be a determinant of under-five year’s mortality in the countries concerned in our analysis. In all countries, the results showed that the probability of dying before the age of five year increased with household size. Thus, children living in large households are more likely to die before their fifth birthday. The results were similar in all countries. Exceptions are in Ghana and Cote d’Ivoire, where the variable sex of the household head was significantly associated to under-five mortality and the results showed that children in households headed by women had a higher probability of dying before their fifth birthday than those belonging to households headed by a man.

Table 4 presents the concentration index for each health outcome by country. The proportions (presented in Table 2 above) are used to calculate the concentration index related to each factor (Table 4). A negative $C_k$ means that the determining factor is more prevalent among the poorest households. To the values of the concentrations of variables, we see that the birth order, maternal age, parity, and household size are potential contributing factors to inequalities in mortality among children under five years.

The mortality of children under five years appears to be higher among children of high birth rank ($C_k = -0.36$ for Ghana, $-0.20$ for Burkina and Benin and $-0.21$ for Cote d’Ivoire), among children whose mothers had high parity among children whose mothers are older and among children belonging to in large households.
### Table 2: Repartition of death by Explanatory variables and countries

| Variables                      | Burkina n | Benin n | Ghana n | Mali n | Nigeria n | Niger n | Cote d'Ivoire n |
|-------------------------------|-----------|---------|---------|--------|-----------|---------|----------------|
| Child’s sex                   |           |         |         |        |           |         |                |
| Male                          | 715       | 106     | 945     | 1,735  | 513       | 198     | 146           |
| Female                        | 613       | 92      | 486     | 1,471  | 443       | 164     | 164           |
| Birth order                   |           |         |         |        |           |         |                |
| 1st                           | 250       | 44      | 222     | 727    | 265       | 60      | 60            |
| 2nd-6th                       | 834       | 121     | 611     | 1,031  | 537       | 201     | 103           |
| 7th & +                       | 244       | 33      | 167     | 225    | 286       | 60      | 60            |
| Mother's age                  |           |         |         |        |           |         |                |
| 15-19                         | 74        | 4       | 2       | 14     | 43        | 9       | 9             |
| 20-24                         | 283       | 4       | 2       | 23     | 63        | 16      | 16            |
| 25-29                         | 365       | 4       | 2       | 14     | 21        | 4       | 4             |
| 30-34                         | 261       | 4       | 2       | 14     | 21        | 4       | 4             |
| 35-39                         | 203       | 4       | 2       | 14     | 21        | 4       | 4             |
| 40-49                         | 47        | 4       | 2       | 14     | 21        | 4       | 4             |
| Mother’s Occupation           |           |         |         |        |           |         |                |
| Not working                   | 246       | 23      | 16       | 179    | 23        | 19      | 19            |
| Sales                         | 211       | 22      | 16       | 179    | 23        | 19      | 19            |
| Parent’s Occupation           |           |         |         |        |           |         |                |
| No education                  | 1184      | 106     | 1,020   | 312    | 695       | 90      | 90            |
| Primary                       | 107       | 106     | 1,020   | 312    | 695       | 90      | 90            |
| Secondary & +                | 37        | 31      | 1,020   | 312    | 695       | 90      | 90            |
| Parity                        |           |         |         |        |           |         |                |
| 1-3                           | 497       | 47      | 1,020   | 312    | 695       | 90      | 90            |
| 4-6                           | 494       | 47      | 1,020   | 312    | 695       | 90      | 90            |
| 7+                            | 337       | 31      | 1,020   | 312    | 695       | 90      | 90            |
| Father’s occupation           |           |         |         |        |           |         |                |
| Agriculture                   | 1039      | 106     | 1,020   | 312    | 695       | 90      | 90            |
| Sales                         | 108       | 106     | 1,020   | 312    | 695       | 90      | 90            |
| Skilled Manual                | 111       | 106     | 1,020   | 312    | 695       | 90      | 90            |
| Other Occupation              | 70        | 106     | 1,020   | 312    | 695       | 90      | 90            |
| Father’s education            |           |         |         |        |           |         |                |
| No education                  | 1145      | 106     | 1,020   | 312    | 695       | 90      | 90            |
| Primary                       | 113       | 106     | 1,020   | 312    | 695       | 90      | 90            |
| Secondary & +                | 48        | 106     | 1,020   | 312    | 695       | 90      | 90            |
| Higher                        | 3         | 106     | 1,020   | 312    | 695       | 90      | 90            |
| DK                            | 5         | 106     | 1,020   | 312    | 695       | 90      | 90            |
| Household size                |           |         |         |        |           |         |                |
| 1-3                           | 217       | 106     | 1,020   | 312    | 695       | 90      | 90            |
| 4-6                           | 441       | 106     | 1,020   | 312    | 695       | 90      | 90            |
| 7+                            | 670       | 106     | 1,020   | 312    | 695       | 90      | 90            |
| Household head’s sex          |           |         |         |        |           |         |                |
| Male                          | 1249      | 106     | 1,020   | 312    | 695       | 90      | 90            |
| Female                        | 79        | 106     | 1,020   | 312    | 695       | 90      | 90            |
| Location of residence         |           |         |         |        |           |         |                |
| Urban                         | 198       | 106     | 1,020   | 312    | 695       | 90      | 90            |
| Rural                         | 1130      | 106     | 1,020   | 312    | 695       | 90      | 90            |
| Socio-economic status         |           |         |         |        |           |         |                |
| Q1 (Poorest)                  | 320       | 106     | 1,020   | 312    | 695       | 90      | 90            |
| Q2                             | 338       | 106     | 1,020   | 312    | 695       | 90      | 90            |
| Q3                             | 288       | 106     | 1,020   | 312    | 695       | 90      | 90            |
| Q4                             | 255       | 106     | 1,020   | 312    | 695       | 90      | 90            |
| Q5 (richest)                  | 127       | 106     | 1,020   | 312    | 695       | 90      | 90            |
| N                             | 1,328     | 106     | 1,020   | 312    | 695       | 90      | 90            |

Source: Demographic and Health Survey (DHS), different censuses in West Africa including Burkina Faso (DHS, 2010), Benin (DHS, 2011), Cote d’Ivoire (DHS, 2011), Ghana (DHS, 2008), Mali (DHS, 2006), Nigeria (DHS, 2008) and Niger (DHS, 2012).

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### Table 3: Adjusted associations between infant mortality and its dominants

| Variables                     | Burkina  | Benin  | Ghana  | Mali  | Nigeria | Niger  | Cote d'Ivoire |
|-------------------------------|----------|--------|--------|-------|---------|--------|---------------|
|                               | Coef.    | Pvalue | Coef.  | Pvalue | Coef.   | Pvalue | Coef.         |
| Child’s sex (Male)            | -0.138   | 0.019  | -0.098 | 0.086 | -0.106  | 0.491  | -0.082        |
| Birth order (1st)             |          |        |        |       |         |        | -0.110        |
| 2nd-6th                       | -0.064   | 0.565  | -0.292 | 0.004 | -0.453  | 0.076  | -0.378        |
| 7th & +                       | -0.893   | 0.000  | -0.980 | 0.000 | -1.180  | 0.014  | -1.014        |
| Mother’s age (15-19)          |          |        |        |       |         |        |               |
| 20-24                         | -0.040   | 0.794  | -0.105 | 0.507 | 1.057   | 0.094  | 0.250         |
| 25-29                         | -0.005   | 0.976  | -0.178 | 0.279 | 0.866   | 0.178  | 0.075         |
| 30-34                         | -0.472   | 0.011  | -0.537 | 0.003 | 0.993   | 0.137  | 0.127         |
| 35-39                         | -0.499   | 0.012  | -0.426 | 0.024 | 1.073   | 0.113  | 0.007         |
| 40-44                         | -0.709   | 0.995  | -0.560 | 0.008 | 0.831   | 0.244  | 0.001         |
| 45-49                         | -0.066   | 0.795  | -0.833 | 0.002 | 0.478   | 0.540  | 0.031         |
| Mother’s Occupation (Not working) |          |        |        |       |         |        |               |
| Sales                         | -0.244   | 0.016  | 0.174  | 0.080 | 0.001   | 0.998  | 0.195         |
| Agriculture                   | -0.216   | 0.009  | 0.055  | 0.892 | 0.267   | 0.346  | -0.021        |
| Manual                        | 0.111    | 0.353  | 0.059  | 0.688 | -0.350  | 0.364  | 0.208         |
| Other occupation              | 0.206    | 0.333  | 0.200  | 0.475 | -0.116  | 0.752  | 0.213         |
| Mother’s education (No education) |          |        |        |       |         |        |               |
| Primary                       | -0.179   | 0.117  | 0.057  | 0.498 | 0.205   | 0.327  | 0.000         |
| Secondary & +                | -0.266   | 0.209  | -0.302 | 0.080 | 0.089   | 0.710  | -0.351        |
| Parity (1-3)                  | 0.741    | 0.000  | 0.805  | 0.000 | 0.772   | 0.001  | 0.483         |
| 4-6                           | 1.945    | 0.000  | 1.776  | 0.000 | 2.176   | 0.000  | 1.530         |
| Father’s occupation (agriculture) |          |        |        |       |         |        |               |
| Sales                         | -0.267   | 0.020  | -0.133 | 0.166 | 0.175   | 0.603  | -0.278        |
| Skilled Manual                | 0.122    | 0.279  | -0.206 | 0.069 | -0.070  | 0.790  | -0.116        |
| Other Occupation              | -0.197   | 0.238  | -0.297 | 0.008 | -0.273  | 0.312  | -0.076        |
| Father’s education (No education) |          |        |        |       |         |        |               |
| Primary                       | -0.201   | 0.064  | -0.133 | 0.083 | 0.254   | 0.348  | -0.046        |
| Secondary                    | -0.092   | 0.617  | -0.045 | 0.661 | -0.863  | 0.000  | -0.363        |
| Higher                       | 0.124    | 0.845  | -0.278 | 0.336 | -0.968  | 0.028  | -0.635        |
| Household’s size (1-3)        |          |        |        |       |         |        |               |
| 4-6                           | -1.037   | 0.000  | -0.849 | 0.000 | -1.102  | 0.000  | -0.940        |
| 7 & +                         | -1.215   | 0.000  | -1.128 | 0.000 | 0.149   | 0.000  | -1.320        |
| Household head’s size (Male)  |          |        |        |       |         |        |               |
| Location of residence(Urban)  | 0.122    | 0.247  | 0.085  | 0.217 | -0.121  | 0.597  | -0.009        |
| Socio-economic status (Q1 (Poorest)) | 0.036  | 0.674  | 0.008  | 0.920 | -0.102  | 0.667  | 0.011         |
| Q2                            | -0.101   | 0.255  | 0.129  | 0.120 | 0.259   | 0.356  | -0.207        |
| Q3                            | -0.143   | 0.127  | 0.058  | 0.560 | 0.157   | 0.642  | -0.172        |
| Q5 (richest)                  | -0.329   | 0.025  | -0.089 | 0.513 | 0.251   | 0.340  | -0.290        |
| Intercept                     | -1.608   | 0.000  | -1.743 | 0.000 | -2.276  | 0.001  | -1.351        |

Source: Demographic and Health Surveys (DHS) different countries in West Africa including Burkina Faso (DHS, 2010), Benin (DHS, 2006), Cote d'Ivoire (DHS, 2011), Ghana (DHS, 2008), Mali (DHS, 2006), Nigeria (DHS, 2008) and Niger (DHS, 2012). Q1 Poorest; Q2 Poorer; Q3 Middle; Q4 Richer; Q5 Richest

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Table 4: Decomposition analysis of concentration index of infant mortality by socioeconomic status

| Variables                              | Burkina C_k | Benin C_k | Ghana C_k | Mali C_k | Nigeria C_k | Niger C_k | Côte d'Ivoire C_k |
|----------------------------------------|-------------|-----------|-----------|----------|-------------|-----------|------------------|
| Child's sex (Female)                   | -0.006      | 0.004     | -0.022    | 0.011    | -0.006      | 0.005     | -0.002           |
| Birth order (1st)                      | 0.009       | -0.004    | 0.000     | 0.001    | -0.007      | 0.029     | -0.030           |
| 2nd-6th                                | -0.209      | 0.389     | -0.203    | 0.343    | -0.357      | 1.131     | 0.264            |
| 7th & +                                |             |           |           |          |             |           | -0.182           |
| Mother's age (15-19)                   | 0.056       | -0.005    | 0.018     | -0.004   | -0.032      | -0.108    | 0.019            |
| 25-29                                  | 0.034       | -0.001    | 0.025     | -0.015   | 0.029       | 0.084     | 0.005            |
| 30-34                                  | -0.003      | 0.004     | 0.020     | -0.023   | 0.106       | 0.353     | -0.007           |
| 35-39                                  | -0.063      | 0.054     | -0.032    | 0.022    | -0.025      | -0.101    | -0.006           |
| 40-44                                  | -0.118      | 0.068     | -0.060    | 0.024    | -0.124      | -0.159    | 0.000            |
| 45-49                                  | -0.105      | 0.003     | -0.185    | 0.033    | -0.261      | -0.081    | -0.001           |
| Mother's Occupation (Not working)      |             |           |           |          |             |           |                 |
| Sales                                  | 0.239       | -0.105    | 0.200     | 0.148    | 0.271       | 0.002     | 0.055            |
| Agriculture                            | -0.111      | 0.144     | -0.319    | -0.077   | -0.459      | 0.799     | 0.000            |
| Manual                                 | -0.142      | -0.018    | 0.248     | 0.009    | 0.115       | -0.039    | 0.013            |
| Other occupation                       | 0.466       | 0.027     | 0.590     | 0.016    | 0.391       | -0.055    | -0.129           |
| Mother's education (No education)      |             |           |           |          |             |           |                 |
| Primary                                | 0.335       | -0.055    | 0.296     | 0.030    | 0.000       | 0.000     | 0.062            |
| Secondary & +                          | 0.742       | -0.062    | 0.656     | -0.076   | 0.330       | 0.141     | 0.041            |
| Parity (1-3)                           |             |           |           |          |             |           |                 |
| 4-6                                    | -0.050      | -0.155    | -0.062    | -0.207   | -0.083      | -0.364    | -0.020           |
| 7 & +                                  | -0.205      | -1.147    | -0.208    | -0.868   | -0.366      | -2.852    | -0.146           |
| Father's occupation (agriculture)      |             |           |           |          |             |           |                 |
| Sales                                  | 0.416       | -0.102    | 0.371     | -0.086   | 0.439       | 0.106     | 0.386            |
| Skilled Manual                         | 0.263       | 0.030     | 0.341     | -0.009   | 0.273       | -0.050    | 0.381            |
| Other Occupation                       | 0.579       | -0.068    | 0.388     | -0.135   | 0.344       | -0.290    | 0.378            |
| Father's education (No education)      |             |           |           |          |             |           |                 |
| Primary                                | 0.304       | -0.060    | 0.116     | -0.036   | -0.185      | 0.082     | 0.111            |
| Secondary                              | 0.681       | -0.026    | 0.430     | -0.026   | 0.201       | -1.018    | 0.523            |
| Higher                                 | 1.000       | 0.003     | 0.798     | -0.027   | 0.540       | -0.390    | 0.762            |
| DK                                     | 0.295       | -0.002    | 0.212     | -0.012   | 0.019       | 0.000     | 0.263            |
| Household's size (1-3)                 |             |           |           |          |             |           |                 |
| 4-6                                    | 0.029       | -0.115    | 0.026     | -0.094   | 0.061       | -0.457    | 0.046            |
| 7 & +                                  | -0.036      | 0.249     | -0.052    | 0.255    | -0.205      | 1.366     | -0.047           |
| Location of residence (Rural)          | -0.155      | -0.183    | -0.178    | -0.111   | -0.298      | 0.385     | -0.014           |

*Source: Demographic and Health Surveys (DHS) different countries in West Africa including Burkina Faso (DHS, 2010), Benin (DHS, 2006), Côte d'Ivoire (DHS, 2011), Ghana (DHS, 2008), Mali (DHS, 2006), Nigeria (DHS, 2008) and Niger (DHS, 2012)*

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Discussion

Results of this study show that the inequalities of the mortality of children under-five remain in West African countries and gaps of under-five mortality between children from wealthy households and those living in poorest household are still important, thus supporting findings of earlier studies (16,37). Findings of the study show that the intensity of inequality varies from one country to another i.e. it is more concentrated in Burkina Faso, Nigeria and Mali and weakly concentrated in Ghana, showing that community or country level conditions can be potential sources of inequalities in mortality and health of children under five years (2,30,31,45). Indeed, Countries involved in this study are all West African countries, where political context, economic development and social policies underway are not the same. These differences could explain differences in inequality of child mortality as observed. Ssewanyana & Kasirye (32) argued that with regard to contextual factors driving health inequalities, political factors are highlighted as major drivers of both income and health inequalities. Findings also showed that socio-economic inequalities of under-five mortality are related to child’s characteristics (birth, gender), to mother’s characteristics (age, the main occupation, parity), the characteristics of the father (education) and to household’s characteristics (size, gender of household head, the standard of living of the household). These variables are been listed in the conceptual frameworks developed for explaining inequality of child mortalities in developing countries (27, 38, 46). Our findings also showed that the birth’s order, mother's age, parity, mother’s occupation and household’s size are major contributors of inequalities of child mortalities by decomposition analysis of concentration index in the countries concerned by the study. Surprisingly, our results do not confirm a strong relationship between the mother’s educational level and location of residence and inequalities in under-five mortality in the countries concerned. Such result was also found in recent research (32,47,48).

Conclusion

The most important conclusion of this study is to reduce mortality in children under 5 years, it is needed to reduce economic and social inequalities and improve the country’s economic and social condition. Tackling under-five inequalities of child mortality could therefore be through specific actions in country level and by stressing family planning programs aimed at promoting the reduction of number of births per women and by increasing women empowerment in economic activities.

Ethical considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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