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**Poverty, Child Mortality and Policy  
Options from DHS  
Surveys in Kenya: 1993-2003**

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# **Poverty, Child Mortality and Policy Options from DHS Surveys in Kenya: 1993-2003.**

**A Research Proposal**

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### **Abstract**

High and rising child and infant mortality rates remain a real challenge for the Kenyan government in her pursuit of Economic Recovery Strategy and Millennium Development Goals for reduction of poverty and health inequality. Against this backdrop, this study aims at informing health policy for Kenya in her endeavors to achieve ERS and MDGs. The study proposes to use DHS data to analyze the determinants of child and infant mortality rates for Kenya between 1993 and 2003. In the absence of income data, the study also proposes to measure and analyze poverty and inequality based on an asset index computed from the DHS data. The study further proposes to relate these poverty and inequality indicators to levels and differences in mortality rates.

### **Introduction**

In Kenya, child mortality rates remain high in spite of the government's commitment to create an enabling environment for the provision of quality health care and reduction of mortality levels. There is clear contrast in recent trends in mortality rates and the trends in the 1960s and the early 1980s. In the immediate post independence Kenya, child and infant mortality rates declined as the rate of economic growth progressed (Hill et al., 2000). Between 1960 and 1980, Kenya enjoyed an impressive and sustained under five mortality rates of about 2-3 percent per annum, thereafter, the rate declined to less than 2% between 1980 and 1990. The impressive decline prior to the 1980s is attributable to the relatively stable macroeconomic environment that spurred growth in post independent Kenya in the 1960s and 1970s. In the early 1980s, macroeconomic instability stemming from both internal and external factors started to reverse the growth rate of the economy and to pose a real threat to many socio-economic aspects of the economy including unemployment and inflation. These were accompanied by deteriorating standards of living and increasing inequality. From 1990, the declining infant and child mortality rates saw a reversal and the rates have since been rising (table 1).

**Table 1: Infant and Under Five Mortality Rates in Kenya (1960-2003)**

	1960	1970	1980	1990	1995	2000	2003
Under 5 mortality rates	205	156	115	97	111	120	123
Infant mortality rates	122	96	73	63	73	77	79

Source: UNICEF Statistics; <http://www.childinfo.org/areas/childmortality/>

The Economic Recovery Strategy (ERS) targets to reduce infant mortality rates from 123 in 2003 to 100 in 2006/2008, while Kenya subscribes to the Millennium Development Goal (MDG) of reducing by two thirds the under-five mortality rate between 1990 and 2015. The specific millennium target for Kenya is to reduce Infant mortality rate from 79 to 25 per 1000 live births and to reduce under-five mortality from 124 to 33 per 1000 live births by 2015. In addition, the goal of the current health sector strategic plan is to reduce health inequalities and reverse the downward trend in health related outcomes and impact indicators. By addressing the major causes of morbidity and mortality, the plan hopes to contribute towards actualization of some of the MDGs and the reduction of existing disparities in health indices between regions, between various population groups and between the public and private sectors (Ministry of Health, 2005). Given the current

rates of infant and child mortality, the country faces a real challenge in the achievement of ERS and MDGs. The proposed study aims at informing health policy in Kenya in her endeavors to achieve ERS and MDGs.

### **Scientific Contribution of the Proposed Study**

Traditional welfare studies measure poverty in terms of deprivation of means (incomes), which lead to analysis of incomes and expenditures. However, one of the key non-metric measures of well being is survival. Sen argues that poverty should be viewed as a deprivation of ends (capabilities and functionings) that are intrinsically important (Sen, 1985). Following Sen's definition of well being, survival (child nutrition and infant mortality) is a basic capability which is an important indicator of well being worth of study just like other measures of welfare. According to Sen's approach, policies should be evaluated not in their ability to satisfy utility or increase income but to the extent that they enhance the capabilities of individuals and their ability to perform socially acceptable functionings.<sup>1</sup>

Previous studies argue that though infant mortality rates are directly linked to incomes, the distributional characteristics of infant mortality are almost certainly more sensitive to the welfare of the poor (Younger, 2001). Infant mortality has also been used as a social indicator of the quality of life of the poor because it is quite responsive to socio and economic conditions. Paxton and Schady (2004) also note that sharp downturns in aggregate income, such as those caused by macroeconomic crises and other factors might all lead to the deterioration in health outcomes (mortality rates and nutritional status). The authors argue that much of the correlation between income and health persists even after taking into account differences in education or access to services. However, other studies argue that the children's health status is not necessarily highly correlated with incomes and expenditures and this makes health status an interesting dimension of well-being to study on its own (see Younger 2001).

From the foregoing, the specific contribution of the proposed study is as follows:

(i) There are increasing empirical studies on poverty and child health determination based on the DHS data. There are also a large number of studies that attempt to identify the determinants as well as principal causes of the health gap between the poor and the better off in both developed and developing countries (Wang, 2002). No such study has been done for Kenya using child and infant mortality as the welfare measure<sup>2</sup>. This study proposes to bridge this knowledge gap.

(ii) Evidence from the DHS show that infant and child mortality rates in Kenya differ by region of residence (rural-urban differences and also provincial differences). Though no

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<sup>1</sup> Functionings are the "beings and doings" of a person whereas capabilities are the various combinations of functionings that a person can achieve. Capability is thus a set of vectors of functionings reflecting the person's freedom to lead one type of life or another (Sen, 1992). In terms of mortality, capabilities would embrace the ability to live through to mature age whereas the equivalent measure of functioning would be the mortality rates.

<sup>2</sup> In an earlier study, we have looked at children's nutritional status as a measure of well being focusing on evolution and determinants (Kabubo-Mariara et. al., 2006).

attempt has been made to link regional differences in mortality to regional differentials in poverty, the regional trends and levels of mortality seem to follow regional trends and levels of poverty. In addition to empirically testing for regional inequalities in mortality rates, the proposed study will also link regional differences in mortality to regional differentials in poverty. This would be of particular interest to policy makers for purposes of regional targeting. In Kenya, the latest regional targeting initiative (constituency development funds) is based on income measures of poverty. Results of this study would provide for broader regional targeting criteria, especially in the provision of health care services.

(iii) The study will also empirically test for gender differentials and inequalities in mortality rates, and correlate these differences to observed differentials in poverty.

(iv) A key contribution of this study also lies in the dataset that we propose to use. Combining three datasets will offer the advantage of a very large sample compared to individual year regressions; which is important for a rare and statistically noisy variable such as mortality rates (Mosley and Chen, 1984). We however cannot use panel data estimation methods because though closely comparable, the dataset for the three years is not panel data.

(v) Another contribution is that this study will attempt to extend microeconomic analysis to include certain time series elements from secondary sources (public expenditure on health, per capita GDP). In addition, we are able to examine the time series of infant mortality in detail. The demographic and household surveys collected information on women's entire birth histories (number of births and survival of children). By using these birth histories, it is possible to construct infant mortality rates for many years prior to the survey date.

### **Main Research Questions:**

The proposed study will address the following research questions:

- 1). To what extent have parental and health care variables accounted for variations in infant and under-five mortality rates in Kenya over the last decade?
- 2). What other factors have contributed to the observed patterns in infant and under-five mortality rates? To what extent do policy variables (access to health care, water supply and environmental factors) contribute to mortality rates in Kenya?
- 3). What is the incidence, prevalence and depth of poverty in Kenya?
- 4). Is there any correlation between household welfare and infant and under-five mortality rates?
- 5). Are there gender differences and inequalities in infant and under-five mortality rates

6). Are there regional inequalities in infant and under-five mortality rates

### **Objectives of the Study**

The proposed study will address two different measures of well-being: (i) Analysis of infant and under five mortality rates and (ii) Poverty and inequality analysis<sup>3</sup>. Due to lack of income measures in the data, we will use the Sahn and Stifel (2003) asset index to rank households by their economic positions. Based on the economic status of the households, the study will:

- Analyze the trends in child health outcomes for Kenya by gender of child and region of residence
- Identify the key determinants of child and infant mortality rates in Kenya- focus on social indicators and key policy variables. The policy variables of interest include health care factors (access to modern contraception, prenatal care, vaccination of expectant mothers, birthing assistance, and vaccination of children born in the past five years); water supply (access to safe drinking water), and environmental factors (presence and type of toilet facilities). To avoid the possible endogeneity that could stem from the joint determination of the policy variable and others that affect mortality probability, these variables will be averaged at the cluster level.
- Investigate the correlation between poverty (and inequality) and mortality rates across regions and gender in Kenya
- Measure the extent of poverty and inequality in Kenya based on the DHS data.
- Use regression analysis to investigate the role of poverty in explaining infant and child mortality in Kenya.
- Draw policies relevant for addressing interventions to reduce inequalities in mortality and poverty in Kenya and also for achievement of millennium development goals.

### **Policy relevance**

The results of the proposed study will be useful to inform policy in two key aspects:

1). Addressing regional inequalities in welfare through infant and under-five mortality rates. In particular the results are expected to highlight the interventions that are likely to be important in achieving lower mortality rates and better welfare across regions in Kenya, and would therefore be useful for regional targeting in provision of healthcare services. This would directly impact on Poverty Reduction Strategy (PRSP) and Economic Recovery Strategy (ERS) objectives in Kenya.

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<sup>3</sup> The study will therefore produce two different papers, one on mortality rates and the other on poverty analysis.

2). The paper will include various policy variables in the analysis. These include health care and basic social utilities such as sanitation and water. Findings will inform policy in light of achievement of the ERS and millennium development goal of significantly reducing under-five mortality rate between 1990 and 2015.

## Methods

The model to be estimated and the choice of variables that determine child health outcomes will be guided by economic theory and empirical evidence from available literature. The conceptual framework for the proposed study will be based on Mosley and Chen’s (1984) child survival model. According to Mosley-Chen, child mortality may change because of changes in background variables operating through proximate determinants or because of changes in proximate determinants themselves. Child survival inputs may be determined by a set of social and economic factors including the household economic profile. We propose to estimate a reduced form model with the following relationships:

$$MR = \alpha X_{it} + \beta S_{it} + \phi C_{it} + \varepsilon_{it} \dots\dots\dots(1)$$

Where MR is a 0/1 indicator of whether a child died before his first/fifth birthday, X is a measure of child characteristics, S is a vector of household characteristics (parental characteristics, fertility preferences, assets measure e.t.c), C is a vector of cluster level characteristics that capture the social environment (including access to health care and environmental factors) that a child lives in<sup>4</sup>. Probit models will be employed to explain the probability of a child dying before a certain age. However, child mortality is more difficult to explain with probit models because probits can only be used to look at five year olds. For child mortality, relative risk models (hazard models) are better suited because they allow us to model the probability of a child dying at age  $x_{t-1}$  (say 13 years) conditional on being age  $x_t$  (say 12 years). Hazard models therefore help to avoid any downward bias in estimation of mortality rates. Use of relative risk models is therefore important because erroneous measures and estimation of mortality would lead to wrong policy implications. This study will adopt this approach for child mortality.

In the mortality regressions, econometric issues such as heterogeneity across clusters (cluster fixed effects), heteroscedasticity, multicollinearity, omitted variables and outliers will be taken care of when carrying out the empirical implementation of the model. Issues such as censoring of the dependent variable will also be taken into account before empirical analysis can be carried out in-order to take care of any possible bias in the measurement of variables.

The DHS data does not contain a module for incomes and expenditure like traditional welfare surveys. For this reason, it cannot be used directly to measure changes in poverty or to make poverty comparisons using the conventional approaches. Instead, Sahn and

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<sup>4</sup> See Strauss and Thomas, 1995 for a discussion on determinants of/and inputs into infant health production functions.

Stifel's (2002, 2003) asset index (see also Filmer and Pritchett, 2000) will be used to quantify measures of the socio-economic status of the households.

The asset index can be defined as:

$$A_i = \sum_k \alpha_k \alpha_{ik} \dots\dots\dots(2)$$

where  $A_i$  is the asset index for household  $i$ , the  $\alpha_{ik}$ 's are the  $k$  individual assets recorded in the survey for that household, and the  $\alpha_k$ 's are the weights. Most studies use the standardized first principal component of the variance covariance matrix of the observed household assets as weights, allowing the data to determine the relative importance of each asset, based on its correlation with the other assets following Filmer and Pritchett (2000). Our approach is to use factor analysis to derive the index following (Sahn and Stifel; 2002, 2003). This approach is similar to principal components but which has certain statistical advantages and assumes that the one common factor that best explains the variance in the ownership of a set of assets is a measure of economic well-being (Sahn and Stifel, 2002). The assets that we propose to include in the analysis are ownership of a radio, TV, refrigerator, bicycle, a motorcycle, a car, the household's source of drinking water (piped or surface water relative to well water); the household's toilet facilities (flush or no facilities relative to pit or latrine facilities); the household's floor material (low quality relative to higher quality); and the years of education of the household head to account for household's stock of human capital. The scoring coefficients from the factor analysis are applied to each household to estimate its wealth index.

The index has been shown to be an important measure of wealth just like expenditures or incomes, whether instrumented or not in explaining health outcomes (Sahn and Stifel 2003, Ssewanyana and Younger, 2005). In addition to the asset index being used as an explanatory factor for mortality, it will also be used to measure the incidence, prevalence and depth of poverty. We propose to apply the standard FGT poverty measures to determine the incidence, prevalence and depth of poverty.

The FGT poverty measures can be defined as

$$P_\alpha = 1/n \sum [(z - y_i)/z]^\alpha ; \alpha \geq 0, \text{ for } y < z \dots\dots\dots(3)$$

Where  $z$  is a predetermined poverty line,  $y_i$  is a measure of economic welfare of household  $i$  (say real in this case measured by the asset index), ranked as  $y_1 \leq y_2 \dots y_q \leq z \leq y_{q+1} \dots \leq y_n$ . The household equivalents of the headcount index, poverty gap index and the squared poverty gap index are obtained when  $\alpha = 0, 1$  or  $2$  respectively. The head count index measures household poverty as a binary variable (poor/non poor). The poverty gap is an aggregate of the preferred measure of household poverty: the shortfall of the assets from the poverty line. The issue that arises with FGT measures is the determination of the poverty line. Given that we base the FGT measures on the asset index, we will explore the determination of the poverty line from conventional approaches, such as setting it at 40% or 60% of the poorest population as this is closely comparable to World Banks

definition of poverty line. Another issue is that our asset index can be negative for the very poor households and has to be transformed into non-negative values for us to estimate the poverty indices and also to estimate inequality measures (Sahn and Stifel, 2003).

In addition to measuring household welfare, we will extend the analysis to welfare dominance analysis, where we propose to apply both primal and dual conditions to test for different levels of welfare dominances (see Duclos and Araar, 2005 for more details on dominance analysis).

To measure inequality, we also propose to apply dominance approaches rather than traditional measures of inequality. This is because the traditional measures (such as the Generalized Entropy measures- the Theil index, Atkinson class of measures and the Gini coefficient) will rank the same set of distributions in different ways because of the differing sensitivity to the wealth measure in different parts of the distribution. Stochastic dominance method can however be applied when ranking of the wealth measure is ambiguous. There are different types of stochastic dominance: The first and second order stochastic dominance are of use in comparisons of social welfare, but the mean-normalized second-order dominance (Lorenz dominance) is associated with unambiguous comparisons of inequality across distributions (Duclos and Araar, 2005).

On the other hand the concentration index will be used to measure the correlation between mortality rates and the asset index across regions. The concentration index is similar to the Gini coefficient, but defined as the ratio of the area between the concentration curve and the diagonal to the area under the diagonal. The concentration curve is constructed by plotting the cumulative proportion of child deaths (on the y-axis) against the cumulative proportion of children (on x-axis), ranked by economic positions (income or other measures of welfare) of the household to which they belong.

Analysis will be carried out both at the regional level and also by gender of the child. We will study whether children from a given region have excess mortality rates compared to children from other regions and whether boys and girls are equally likely to die given the same characteristics.

## **The Data**

To analyze poverty dynamics, panel data or closely comparable data is best suited. The conventional dataset that can be used for such purposes in Kenya is the Welfare Monitoring Data for which 4 series are available (1982, 1992, 1994 and 1997). While such data is good for comparing money-metric measures of poverty, it lacks enough information for non-monetary poverty comparisons. Furthermore, the data is quite outdated given that the latest dataset was collected nearly a decade ago (1997). The next comparable dataset in the series (Kenya integrated Household Budget Survey-KIHBS) may not be available until 2007 because the survey will be completed in 2006. Even then, there are issues of comparability of the surveys (see Kabubo-Mariara and Ndeng'e, 2004).

Given the limitations of the Welfare Monitoring Survey data, the DHS data provides a ready alternative and is ideal to make inter-temporal and cross country comparisons in non-monetary measures of poverty. DHS are nationally representative data based on women aged 15 to 49 years. Though comparable across years, the DHS is not a panel and new surveys may contain modules excluded in earlier surveys. This study proposes to use the 1993, 1998 and 2003 DHS datasets for Kenya to achieve the objectives of the study. The data is rich in information on demographic, nutrition and health information and is therefore adequate to answer the key research questions of this proposed research. We will explore the possibility of supplementing the DHS data set with secondary data such as public expenditure on health and per capita GDP. We however acknowledge that there is a drawback in such an exercise because secondary data is highly aggregated and in some instances not even available at the district level.

### **Dissemination Strategy**

Working papers of the study will be presented and discussed at various research forums including seminars at the host institution and also for peer review at PEP workshops. Draft reports may also be presented and discussed in other relevant national and international conferences. Policy briefs will be made available to policy makers in Kenya and also to the public. The final report of our study will be made available in the form of a PEP working paper as well as working papers for the Department of Economics. Excerpts of the study will also be submitted to renowned journals for publication.

### **Key References**

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## **Prior Training and Experience of Team members in Issues and techniques involved**

Dr. Kabubo-Mariara is a development economist by training and has considerable research experience in poverty, labour market and income distributional issues. She also researches on development and environment economics with a bias on the interaction between poverty and environmental variables. Dr. Kabubo-Mariara has won several research grants in her areas of specialization from both local and international organizations. Participation in collaboration projects, both locally and internationally has played an important role in enhancing her research capacity. Currently, she is the team leader (for Kenya) of the collaborative research project on poverty, labour market and income distribution funded by the AERC. The team is working on aspects of regional and institutional determinants of poverty focusing on monetary (income) and non-monetary measures (nutrition and education). She has been a visiting scholar to Cornell University (1998, 2004 and 2005) where she received training on use of DHS and construction on the asset index. She has applied this index in analysis of child nutritional status for Kenya.

She is also the team leader for a project on Poverty, Vulnerability and Environmental Management in Kenya, a collaborative project with researchers from the Institute for Environmental Studies of Vrije Universiteit, Amsterdam (funded by the Netherlands Ministry for Foreign Affairs). In addition, she is also participating in a research project on the impact on climate change on the welfare of agricultural households in Kenya, part of a larger regional project involving 8 African countries. The research is a collaborative project with researchers from Yale University, the World Bank and the Center for Environmental Economics and Policy in Africa (CEEPA) of the University of Pretoria, funded by the Global Environment Facility and the World Bank. In this project Dr. Kabubo-Mariara is the economist (Ricardian analyst) for the Kenyan country study.

Ms. Margaret M. Karienyeh holds a B.Sc. (Hons.) in Agricultural Economics from Egerton University, Kenya. Currently she is a Master of Science student in Agricultural Economics at the University of Nairobi. She has successfully completed her course work and is in the process of writing her dissertation. Her research interests are in the field of household welfare, land tenure security and gender outcomes, more so for agricultural households. She has considerable experience in farm management, coordination of agricultural extension programs, training of agricultural extension officers and implementation of government agricultural programs.

Mr. Francis K. Mwangi holds a B.A (Hons) degree in Economics from the University of Nairobi, Kenya. Currently he is a Master of Arts student in Economics at the University of Nairobi and is in the process of taking his coursework. His research interests are in poverty and economic growth related issues.

## **Expected capacity building for researchers and institutions**

This study has potential to built capacity in two ways: (a) at the individual and institutional levels. At the individual level, the two students (Margaret and Francis) will benefit from the study in several ways: (i) Learn how to use large survey datasets (ii)

Learn how to construct the asset index, compute poverty indices and inequality measures. (iii) Get exposed to new issues and literature on wellbeing and child health. (iv) Learn how to use DAD software and other training materials available from PEP to enhance their analytical capacity. (v) Gain in terms of improved writing skills and publication. (vi) Francis will use and extend the poverty analysis in this project to write his Master of Arts thesis.

In addition, the lead researcher will gain through analysis of data and writing and also from training and collaboration with PEP supervisors.

(b) The knowledge gathered will then be used in teaching and further research and therefore build capacity at the institutional level.

The lead researcher will be in charge of the overall implementation of the project and will train the junior researchers on all aspects of the projects. The co-researchers will participate in all aspects of the project under the guidance of the lead researcher.

**Any Ethical, social, gender or environmental issues or risks which should be noted**

None.

**List of projects in related areas involving team members**

2003-2006: Kabubo-Mariara J., G.K. Nd'enge and D.M. Kirii. Evolution and Determinants of Non-monetary Indicators of Poverty in Kenya: Children's Nutritional Status, 1998-2003. (Funded by African Economic Research Consortium)

2003-2006: Kabubo-Mariara J., D.M. Kirii, G.K. Ndeng'e and J.B. Kirimi. Regional and Institutional Determinants of Poverty: The Case of Kenya. (Funded by African Economic Research Consortium)