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D. Walter Rasugu Omariba
University of Western Ontario

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by
D. Walter Rasugu Omariba

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email: dwomarib@uwo.ca
Fax: 519-661-3200

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Population Studies Centre
University of Western Ontario
London CANADA N6A 5C2

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ABSTRACT

This paper utilises data on women from the 1998 Kenya Demographic and Health Survey to examine the conditions under which children under the age of five remain healthy or become ill with three fatal diseases, namely, malaria, diarrhea, and acute respiratory infection. The major objective of the paper was to identify the principal determinants of child morbidity and to pinpoint possible areas where current health programmes could be improved to secure greater child survival. Logistic regression is applied on the data to examine the relationship between women status as indicated by various social and economic factors and the morbidity status of their children. The results show that the marital status, mother's age, number of children living at home, and region are significant in predicting the morbidity status of children for all the three ailments. The results also show that the location of the household on the wealth scale, occupation status, religious affiliation, literacy status and education were significant in predicting the morbidity status of children for either one or two ailments. On the other hand, media use, and household environmental conditions were not significantly associated with the morbidity status of children for any of the ailments. The factors identified as significant in predicting the morbidity status of children have provided an indication of the direction health programmes could take. There is need for the government to continue efforts to increase availability of health services especially in rural areas. In addition, since the sicknesses considered in this analysis are largely preventable, strengthening various components of the Primary Health Care health provision strategy could substantially improve the health of children.

Key Words: Child Morbidity; Morbidity status; Determinants of morbidity; Child Mortality; Women status

INTRODUCTION

Although remarkable declines in infant and child mortality have been observed in the developing world since the end of the Second World War, the magnitude of the decline varies across countries, with sub-Saharan Africa being much slower in catching up with the rest of the developing world(Behm-Rosas, 1987). High mortality among children, therefore, remains a serious public health concern in sub-Saharan Africa. Kenya, just as most African countries for which data are available, started experiencing declines in child mortality since the late 1940s (Hill and Hill, 1988). Although the decline continued throughout the 1960s, 1970s and 1980s (Ewbank et al. 1986), data from the 1998 Demographic and Health Survey (DHS) show that childhood mortality conditions worsened during the 1990s. For instance, the under five mortality, which is the probability of dying before the fifth birthday, stands at 112 deaths per 1000 live births, this representing a 24 percent increase over the preceding decade (National Council for Population and Development, 1999). These worsening mortality conditions suggest that improved health and nutrition conditions that were responsible for the earlier decades declines have deteriorated.

There has been much child mortality analysis done in Kenya mainly utilising census and survey data (See, for instance, Obungu et al., 1994; Ewbank et al., 1986;Kichamu, 1986; Kibet, 1981). However, literature on morbidity patterns among Kenyan children below the age of five is largely non-existent. Costello et al. (1996), writing in relation to Philippines, observe that the abscence of morbidity studies is regrettable because a large number of child deaths must first pass through one of the intermediary disease states. It seems, therefore, that the relationship between morbidity and death is held as obvious and needing no analysis on its own, while the sickness leading to the death is considered as a one-time event. However, as Mosley and Chen (1984) have argued, death among children should be studied as a chronic disease process with multifactoral origins than as an acute single-case phenomenon.

Demographers, almost invariably, hold that there is a relationship between socio-economic status and levels and patterns of mortality in all populations. However, Mosley and Chen (1984) observe that how these determinants operate to produce the observed mortality differentials remain largely an unexplained 'black box'. This is a disturbing fact particularly in terms of efforts toward theory developments. As Costello et al. (1996) note, focussing on social and economic differentials in mortality rates means that the intervening linkages, which are a prerequisite for any good theory, are never grasped. Often, the explanations of mortality differences refer to child care practices which should be the domain of morbidity studies. The question then should not be why more children of women who cannot read or with no education die, but rather why they become sick. Mortality studies could therefore be asking the wrong questions or proceeding on a fallacious premise. Obviously most children die because they are sick and so of initial and primary concern to researchers in mortality should be the conditions that predispose children of certain mothers to states that heighten their likelihood of death.

The increasing mortality levels in Kenya suggest that focus should now shift from mortality differentials to that of the preceding states, that is, morbidity differentials. Utilising national-level data from the 1998 Kenya Demographic and Health Survey (KDHS), this study responds to this need. The analysis is based on the KDHS sample of 7,881 women and considers three of the most common and potentially fatal childhood sicknesses in Kenya namely malaria, diarrhea and acute respiratory infection (pneumonia). The study seeks to answer one question for each of these ailments: what factors influence the probability that a woman's child would contract either malaria, pneumonia or diarrhea. Although the 1998 KDHS data set on childhood morbidity is extensive, the analyses done so far are disparate and cursory at best. As an example, the KDHS 1998 report, following the tradition of preceding DHS reports, provides national morbidity levels and links them to only three socio-economic differentials, place of residence, region and mother's education (NCPD, 1999). In addition, this information is mainly descriptive and hence offers marginal understanding to the complexities related to childhood morbidity. On the contrary, the current analysis is conceptually exploratory and therefore broadens the search for potential determinants of morbidity.

Malaria, diarrhea and pneumonia have been identified as major contributors to deaths among children. The World Health Organisation (WHO) has estimated that diarrhea, for instance, is responsible for more than 3 million deaths every year globally among children under the age of five. Malaria, on the other hand, accounts for between 15 and 25 percent of deaths among children under five (WHO, 1995). Given that a large proportion of the world's population lives in developing countries, most of these deaths occur among children in these regions, with the morbidity patterns showing little variation between the countries. In 1998, for instance, 42.3 percent of children less than three years in Kenya had malaria, 17.2 percent had diarrhea while 20.1 had pneumonia (National Council for Population and Development, 1999).

It is indubitable that the curative intervention for diarrhea, oral rehydration therapy (ORT), and for malaria, use of various antimalarial medicines, are effective treatments for these ailments. However, it can be strongly argued that the preventive approach is more sustainable given the country's level of socio-economic development and uneven distribution of health resources. In addition, the specific curative interventions have been found inefficient and unreliable in different areas for a number of reasons. Yeneneh et al. (1993) observe that in Ethiopia the lack of availability and cost of antimalarial medication limits their wider use in the treatment of sick children. Ryland and Raggers (1998) also add that preference for home remedies might be a further impediment. In the case of diarrhea, Widarsa and Munijaya (1994) found that in Indonesia oral rehydration salts (ORS) packets are unavailable in many areas. Ryland and Raggers (1998) analysing DHS data for 34 countries found that use of oral rehydration solution (ORS) or oral rehydration therapy (ORT) was not widely reported, a state they attributed to its unavailability.

An important objective of this analysis is to provide information for policy makers and health planning managers. Regional comparisons, for instance, should provide us some indication of the differential levels of development between regions, and differences in certain ecological conditions associated with the aetiology of disease that may exist between regions. In addition, the study should serve to highlight social and economic determinants of child morbidity and identify the groups who are at more risk, and for whom intervention and preventive programmes focussing on these diseases should target. A study on the manner of response to these diseases is definitely a good indicator of the household's ability to access medical care and the general health seeking behaviour in households. In addition, it can provide invaluable information for the design and implementation of appropriate intervention. However, a good starting point is the determination of the level and prevalence of the forms of sickness in a community.

CONCEPTUAL FRAMEWORK

Mosley and Chen's (1984) "proximate determinants of health dynamics" model is an appropriate analytical framework for identifying the major variables to be analysed in this study. They note that medical research focusses on biological processes of diseases, less frequently on mortality *per se*, while social science research primarily focusses on socio-economic differentials of mortality and largely ignore specific causes of death. Further, the selection of a particular approach usually results in policy and programme recommendations biased along disciplinary lines. This means that sickness being a multifactoral event, such compartmentalised knowledge seeking has impeded the development of useful approaches to understanding child survival. Discipline-biased intervention programmes also achieve little through their strategies directed toward reducing morbidity and mortality. This particular model, however, incorporates both social and biological variables. Its premise is that all social and economic determinants of child mortality necessarily operate through a common set of biological mechanisms or proximate determinants; that include maternal, and environmental factors, nutritional deficiency, injury and personal illness control in affecting mortality (Mosley and Chen, 1984).

Several studies have demonstrated that unlike adults, children face a greater threat to their health and well-being from exposure to parasitic and infectious diseases including malaria, diarrhea, pneumonia, tetanus, and measles due to the vulnerability of their young bodies; and that this exposure is conditioned by household environmental conditions, social, economic and ecological factors (Mott, 1982; Mahadevan et al., 1986; Meegama, 1986; Ryland and Raggers, 1998;Costello et al.; 1996; Gage et al., 1996). The conditioning factors are the ones usually identified as mortality differentials (UN, 1985; 1986). Due to the paucity of studies on Kenya linking socio-economic factors to morbidity per se it is within logical bounds to expect that the characteristics associated with low rates of childhood mortality would also be associated with low rates of morbidity. Although response to sickness is not analysed it can be rightly assumed that women reporting less incidence of sickness among their children are those who take preventive measures to avoid illness. The factors considered in the analysis can provide an indication of this behaviour.

In line with the "proximate determinants of health dynamics" model, the argument I make here is that the education, information, economic resources and the like should lead to improved status on the various proximate determinants of mortality, including , poor housing, unsafe water, unsafe faecal disposal, and lack of access to preventive health care technologies. To the extent that this improved status is achieved, the probability of contracting any of the diseases that could lead to growth faltering or mortality will be reduced. The background variables (e.g. women's literacy, region of residence, marital status) therefore operate through intervening variables (e.g. sanitation, number of children living in the household, age of the mother) to influence the morbidity status of the child. For instance, it would be expected that women with higher education attainment are likely to have lower incidence of reported illness perhaps because of living in households with access to safe water and hygienic sanitation facility. This manner of proposition implies that sickness is not only multifactoral but defining the specific nature of operation of the variables may not be so obvious, therefore this study remains largely exploratory.

DATA SOURCE AND METHODS

One of the key objectives of the 1998 Demographic and Health Survey was to examine the basic indicators of maternal and child health in Kenya (NCPD, 1999). In relation to childhood morbidity, the survey collected information on disease prevalence, treatment patterns, preventive health practices, mainly immunisations against childhood diseases (diphtheria, measles and polio) and nutritional practices, particularly those relating to breastfeeding. The presence of diarrheal disease was ascertained by a single question which read *"Has (name of the child) had diarrhea in* *the last two weeks?* ". The incidence of malaria was similarly determined by one item which read " *Has (name of the child) been ill with fever at any time in the last two weeks*". Although, this is not a direct question on malaria, in demographic and health surveys as in others morbidity studies it is rightly assumed that most of the fevers in tropical countries are due to malaria (Ryland and Raggers, 1996).There were two items that inquired into the incidence of cough, and short or rapid breathing during the two weeks preceding the survey. However, for this analysis, only the second item has been utilised as it represents a clear case of pneumonia. In addition, the survey included a large number of potential determinants of morbidity that represent three levels of analysis: characteristics of the mother (e.g. education level, literacy, marital status, religion), of the household (e.g. availability of sanitary facilities, source of water, residential crowding), and community (e.g. region). These factors which indicate the socio-economic status of women are important predictors of the likelihood child illness, and can form a basis of a preliminary investigation seeking to demonstrate the patterns of child morbidity.

As any other questions asked about children in surveys, mothers' responses on children's illness are likely to be inaccurate. In the KDHS, several questions were asked on each of the diseases to ensure that the mothers were able to identify the particular disease the child suffered. For instance, although the specific name 'malaria' is not used in the schedule, mothers were asked to mention whether their children had fever and to describe the symptoms which included increasing or high fever, recurrent fever, noisy breathing, convulsions, shivering, inability to drink, not eating or drinking well and not getting better. However, Mosley and Waters (1996) observe that each disease is a symptom complex that is a result of a multiplicity of infectious agents. This means that in the case where malaria is accompanied by diarrhea for instance, the mother may fail to identify the type of sickness. In addition, mothers may forget the exact time period the sickness occurred. The incidence of sickness may therefore be underestimated or overestimated; with the former having potentially serious repercussions for health planning and intervention while the latter could lead to waste of meagre resources.

It is has been demonstrated that in cases where mothers do not live with their young children (or stay away from them for a considerable length of time during the day), the reported estimates on child sickness may also be biased. Ryland and Raggers (1998), for instance, have shown that throughout the regions of the developing world, the proportion of fostered children whose mothers did not know they had diarrhea was substantially higher than the proportion of children living with their mothers. It has been suggested that the analysis be restricted to mothers who were actually living with their young children at the time of the survey as a way to overcome this potential bias. However, I argue that when sickness occurs mothers are likely to be the ones primarily responsible for the care of the child. The actual extent of fostering in Kenya, from which a reasonable assessment of the need to adhere to this prescription can be made, is also not known. In addition, considering the age of the children for whom information on the sickness was asked, children less than three years of age, it is doubtful that these were living away from their mothers. The preceding consideration has therefore been ignored in this analysis.

The accuracy of reporting of incidence of sickness and type of sickness however, varies by certain characteristics of the mother, particularly mother's level of education; more educated mothers are likely to give accurate response (Boerma et al., 1991). However, in Kenya where the majority of rural females may not attend school for a variety of reasons, but mainly cultural ones which privilege boys over girls, literacy status on its own may significantly affect accuracy of reporting.

Literate mothers therefore, are likely to report whether their children were sick and accurately identify the type of sickness.

Since the dependent variables are categorical, logistic (logit) regression has been utilised in this multivariate analysis. Logistic regression models are commonly estimated by maximum likelihood, with the *likelihood function* expressing the probability of obtaining the observed sample as a function of model parameters, rather than by least squares (Hamilton, 1992). For each of the three ailments this involved a binary choice model. Since our logistic function deals with estimated probabilities, our multivariate binary models are specified as:

$$\text{logit } P=\text{Ln}(P/(1-P)) = b_0 + b_1x_1+b_2x_2+b_3x_3+b_4x_4+....b_ix_i$$

where b_1, $b_{2,}$ $b_{3,}b_4$ and $b_{i,}$ represent the coefficients of each of the independent factors while x_1, $x_{2,}x_{3,}x_{4,}x_i$ represent the predictor variables included in the model. P is the probability of falling ill, while 1-P is the probability of a child not having any of these ailments during the reference period. Using the resulting logit coefficients we have computed odds ratios for the interval ratio variables and for the various categories of the categorical predictor variables. The odds ratios are the measure of the odds that a woman's child suffered illness during the reference period as indicated by the independent variables. For each of the estimation models, three sets of statistics have been computed: individual model logit coefficients, tests of significance, and odds ratio. Care must be taken, however, not to interpret these variables as causes of these ailments. This is not only because it is the mothers' characteristics and not those of the children that are considered, but also because a woman's assessment of the nature of the disease may be erroneous, meaning that some other sickness has been classified as malaria, or any of the other ailments. Again, these factors only provide an indication of what conditions are favourable, for instance, to the vectors that cause malaria, mosquitos, and by themselves are not the cause of the child being sick.

Table 1:Definition of Predictor Variables Used in the Logistic Regression Analysis of Childhood Morbidity Based on the 1998 KDHS Women's Sample

Region: Set of six dummy variables (Nairobi, Central, Coast, Eastern, Nyanza, and Western) representing seven regions of the country covered in the survey. Rift Valley province is the reference category.
Literacy status: Set of two dummy variables (Reads easily, and reads with difficulty) representing respondent's literacy status. Those who cannot read at all are the reference group.
House quality: Set of dummy variables constructed from survey items on type of flooring and roofing material. These are 'cement floor/tiled roof', 'cement floor/corrugated iron sheet roof', and 'mud, dung floor/corrugated iron sheet' roof'. Respondents living in houses made of 'mud, dung floor/grass thatched roof' were treated as the reference category.
Sanitation: Set of four dummy variables constructed from survey items on source of water and type of toilet facility. These are 'piped water/flush toilet', 'well water/pit latrine', 'surface water/no toilet facility', and 'surface water/pit latrine'. Respondents living in households using surface water/pit latrine were treated as the excluded category.
Age of mother: Age of the mother as of the date of survey.
Number of children at home: Number of children born to a woman who were living at home as of the date of survey. Interaction terms involving marital status and age of the mother and number of children were also included in the models.
Religion: Set of three dummy variables (Catholic, Muslim, and No religion) representing the religion a respondent is affiliated to. Protestants and other Christians were the reference group.
Ownership of consumer items: Score on a scale of consumer goods owned, as derived from individual items on ownership of radio, television, refrigerator, bicycle, motorcycle and car.
Media use: Set of dummy variables representing four possible scores on media-use scale. The survey questions concerned reading a newspaper once a week, listening to the radio everyday and watching the television every week. Respondents who used all three types of media were the reference group.
Marital status: Two dummy variables (Never married and once married) representing respondent's marital status. Respondents who reported their status as 'currently married at the time of the survey were treated as the excluded category.
Occupation: Set of five dummy variables (Professionals; clerical, sales and service; agriculture self-employed; unskilled manual; and skilled manual) representing a respondent's type of occupation. Respondents who are 'not working' were treated as the reference category.
Education: Set of four dummy variables (No education, incomplete primary education, complete primary education and incomplete secondary education) representing a respondent's highest education level attained as of the date of survey. Respondents with 'complete secondary or higher' education were treated as the reference group.

RESULTS

The descriptive results of the analysis show that 16% of the sampled women reported that their children had malaria, while 7% and 8% reported incidence of diarrhea and pneumonia respectively among their children during the reference period. These figures would undoubtedly be higher if the reference period were extended, or if children data was utilised. The study examined the relationship between a woman's child morbidity status and twelve independent variables. Table 2 presents the significance levels of results from applying logistic regression models to the KDHS women sample data.

Table 2: Results of the significance level from logistic regression analyses of morbidity status

	Morbidity status		
Independent variable	Malaria	Diarrhea	Pneumonia
Media use	.060	0.82	.177
Number of children at home	.001	.001	.001
Region	.001	.001	.001
Age	.001	.001	.001
Marital status	.001	.001	.001
Religion	.020	.823	.525
Occupation	.391	.024	.235
Housing quality	.761	.677	.195
Sanitation	.289	.574	.337
Ownership of consumer items	.212	.002	.647
Education	.020	.020	.620
Literacy status	.030	.144	.291
Interaction between children at home and mother's age	.001	.001	.001
Interaction between Marital status and number of children at home	.001	.001	.001

Source: 1998 Kenya Demographic and Health Survey
The relationship was tested at 95% confidence level. A two tailed test.

The analysis shows an insignificant effect of media use, occupation, house quality, sanitation, and ownership of consumer items and incidence of malaria. In the case of diarrhea, the results show an insignificant effect of media use, religion, house quality, sanitation, and literacy status. The results also show that a large number of variables were insignificant in predicting the likelihood of a woman's child having pneumonia. Overall, the results show that for all three ailments the age of the mother, region of residence, number of children living at home, and marital status significantly influence the morbidity status of a woman's child. The interaction terms between mother's age and number of children at home; and between marital status and number of children at home were also significant for all the three ailments. Other variables were significant in one or two ailments and insignificant for the other. Education was significant for both malaria and diarrhea but insignificant for pneumonia. Whereas literacy status was significant for malaria it was insignificant for diarrhea and pneumonia; while ownership of consumer items was significant for diarrhea but insignificant for the other two ailments.

Tables 3a, 3b and 3c present the estimated coefficients and odds ratios of the significant predictor variables resulting from the logistic regression models reported in Table 2. Table 3a presents the coefficients, standard errors and odds ratio for the malaria model, and 3b and 3c for the diarrhea and the pneumonia models respectively.

Region

There are regional differences in the morbidity status of children. The results show that the odds that a woman's child would have malaria are highest for women living in Western (89.8%) and lowest in Central province (11.9%) as compared to the reference category, Rift Valley. Additionally, women living in Nyanza (odds ratio= 1.353), Eastern (1.115) and Coast (1.092) have relatively higher likelihood of their children suffering malaria as compared to those in the Rift Valley region.

Table 3a: Logistic Regression Coefficients and Odds Ratio for the Malaria Estimation Model

Independent variable	Coefficient	Standard Error	Odds Ratio
Region:			
Nairobi	-.023	.220	.977
Central	-.127	.152	.881
Coast	.088	.148	1.092
Eastern	.109	.121	1.115
Nyanza	.302	.114	1.353
Western	.641	.123	1.898
Rift Valley	*	*	*
Age of mother	-.806	.010	.917
Number of children at home	1.205	.094	3.337
Religion:			
Catholic	.159	.083	1.173
Muslim	.014	.194	1.014
No religion	.565	.215	1.759
Protestants/Other Christian	*	*	*
Marital status:			
Never married	-2.255	.178	.105
One married	-.159	.256	1.173
Currently Married	*	*	*
Education:			
No education	-.134	.225	.874
Incomplete primary	-.351	.143	.704
Complete primary	-.050	.133	.951
Incomplete secondary	-.247	.157	.781
Complete secondary/Higher	*	*	*
Literacy status:			
Reads easily	-.031	.168	.970
Reads with difficulty	.233	.162	1.262
Cannot read	*	*	*
Interaction between children at home and mother's age	-.023	.003	.977
Marital status and children at home:			
Never married&children at home	.966	.108	2.627
One married&children at home	-.159	.153	.853

Source: 1993 Kenya Demographic and Health Survey
The relationship was tested at 95% confidence level
** Reference category*

An almost similar pattern as that of malaria is also observed for diarrhea. Women living in Western province have the highest odds that their children would suffer diarrhea. The odds ratio

(1.715) suggest that living in this region increases the odds that one’s child would have diarrhea by 71.5%. Living in Eastern region is associated with an increase odds by 8.7% that one’s child would have diarrhea. However, women living in Nairobi have the lowest odds that their children would have diarrhea. The odds (.476) suggest that living in this region which house the country’s capital city reduces the odds of one’s child suffering diarrhea by 52.4%. Similarly, living in Central (odds ratio= .488), Coast (odds ratio=.764) and Nyanza regions (odds ratio=.946) is associated with decreased odds that one’s child would have diarrhea.

The results of the pneumonia model show that women living in Eastern region have the highest (odds ratio=1.759); while women in the Coast region have the least (odds ratio=.699) odds of their children having pneumonia. Whereas living in Eastern region increases the odds of a woman’s child having pneumonia by 76%, the relative increases for the other regions include 0.1%, 0.6%, and 6.4% for Nairobi, Western and Nyanza respectively. On the other hand, living in Coast and Central regions reduces the odds by 30.1% and 7.6% respectively.

Age of Mother and Number of Children at Home

The age of the mother is an important demographic variable in the study of fertility and child mortality. Age not only determines when women begin child bearing but it is also an important factor in the analysis of fertility and child mortality relationships. It is therefore important in the study of morbidity. The results show that children of younger mothers are more likely to suffer malaria than those of older mothers, which confirms that mother’s age is significant in predicting the morbidity status of their children. The results imply that for every one year increase in the age of the mother, the odds that their child would have malaria decline by 8.3%. On the other hand, an increasing number of children living at home is associated with heightened risk of a woman’s child having malaria (odds ratio=3.337). The interaction between the two variables exerts a negative effect (odds ratio=.977).

With only a slight change in the values of the odds ratios, the same pattern holds in the diarrhea and pneumonia models. The odds ratios for age of the mother are .905 and .923 for diarrhea and pneumonia respectively; while that for the number of children living at home are 2.148 ands 2.569. The interaction in both ailments exerts a negative effect. The results suggest that young mothers with many children living at home would have higher odds of their children suffering from malaria, pneumonia and diarrhea than older women with children of comparable numbers living at home.

Marital status and Number of Children at Home

Marital status is an important factor to consider when studying fertility or child mortality. This is because most births occur within the context of some form of conjugal union. This, in part, explains why it makes sense to examine the morbidity status of children born to women of various marital statuses. The results invariably demonstrate that women who have never been married have higher odds while the once married (separated, divorced or widowed) have lower odds than married women of their children having malaria. Being single and number of children living at home has a positive effect (odds ratio=2.627) while being separated, divorced or widowed number of children living at home exerts a negative effect (odds ratio=.853) on the malaria status of the child. This suggests that adding one child to the number of children at home decreases the odds that a child would have malaria by 15% among the once married.

Except for the once married group in the diarrhea estimation model, the same pattern holds for the pneumonia and diarrhea models. The never married have the highest odds that their children would suffer either from pneumonia or diarrhea. On the other hand, the once married are somewhat different from the married. The odds that a child of an unmarried woman would have diarrhea or pneumonia for every additional child to the number of children living at home are quite high, 2.266 and 2.096 respectively. On the other hand, the odds for the once married are 1.037 and 0.921 for diarrhea and pneumonia respectively. These results suggest that as the number of children living at home increase the odds that a child of an unmarried women would have any of the three ailments substantially increases. On the other hand, the odds for the once married women are reduced by 8% for pneumonia while that of diarrhea increase by about 4%.

Education

The relationship between education and child mortality is one that demographers have examined closely (Caldwell, 1979; Ware, 1984; Caldwell et al., l992). It is expected that the children of more educated women are more likely to survive than those of the uneducated or less educated. By the same token, the incidence of sickness among children of more educated is likely to be lower. The results show that women of the other education levels including those with complete primary education (odds ratio=.951), no education (odds ratio=874), incomplete secondary education (odds ratio=.781), and incomplete primary education (odds ratio=.704) have lower odds than those who have completed secondary or higher education that their children would have malaria. These findings are surprising as they contradict the expected pattern of the education-morbidity relationship.

Table 3b: Logistic Regression Coefficients and Odds Ratio for the Diarrhea Estimation Model

Independent variable	Coefficient	Standard Error	Odds Ratio
Region:			
Nairobi	-.742	.387	.476
Central	-.718	.258	.488
Coast	-.270	.217	.764
Eastern	.083	.162	1.087
Nyanza	-.055	.158	.946
Western	.539	.162	1.715
Rift Valley	*	*	*
Age of mother	-.100	.015	.905
Number of children at home	.765	.125	2.148
Ownership of consumer items	-.210	.069	.810
Marital status:			
Never married	-2.536	.263	.079
One married	-.254	.355	.776
Currently Married	*	*	*
Education:			
No education	.664	.331	1.942
Incomplete primary	.387	.242	1.472
Complete primary	.674	.230	1.962
Incomplete secondary	.548	.256	1.730
Complete secondary/Higher	*	*	*
Occupation:			
Professionals	.212	.380	1.236
Clerical, Sales, Service	.272	.157	1.312
Agriculture self-employed	.318	.127	1.374
Unskilled manual	.739	.260	2.094
Skilled manual	-.035	.409	.965
Not working	*	*	*
Interaction between children at home and mother's age	-.013	.004	.987
Marital status and children at home:			
Never married&children at home	.818	.124	2.266
One married&children at home	.036	.107	1.037
Currently Married	*	*	*

Source: 1993 Kenya Demographic and Health Survey
The relationship was tested at 95% confidence level
** Reference category*

In the case of diarrhea although all the other groups have higher odds than the reference category, there are substantial differences between the groups. Women who have completed primary education have the highest odds of their children having diarrhea (odds ratio=1.962) followed by those with no education (odds ratio=1.942). These results suggest that completing primary schooling increases the odds of one's child having diarrhea by 96.2%, not completing secondary school increases the odds by 73%, and not completing primary school by 47.25. On the other hand, having no education increases the odds that one's child would have diarrhea by 94.2%.

Literacy Status

Literacy status was only significantly associated with malaria. The results show that women who read with difficulty have higher odds (odds ratio=1.262) that their children would have malaria. This suggests that belonging in this group increases one's odds that their child would have malaria by 26%. On the other hand, although being able to read with ease is associated with lower odds that one's child would have malaria the effect is marginal (3%) .

Table 3c: Logistic Regression Coefficients and Odds Ratio for the Pneumonia Estimation Model

Independent variable	Coefficient	Standard Error	Odds Ratio
Region:			
Nairobi	.001	.314	1.001
Central	-.079	.204	.924
Coast	-.357	.220	.699
Eastern	.565	.145	1.759
Nyanza	.062	.150	1.064
Western	.006	.169	1.006
Rift Valley	*	*	*
Marital status:			
Never married	-2.337	.250	.097
One married	-.117	.334	1.124
Currently Married	*	*	*
Age of mother	-.080	.014	.923
Interaction between children at home and mother's age	-.018	.004	.982
Number of children at home	.944	.121	2.569
Marital status and children at home:			
Never married&children at home	.740	.121	2.096
One married&children at home	.082	.109	.921
Currently Married	*	*	*

Source: 1993 Kenya Demographic and Health Survey
The relationship was tested at 95% confidence level
** Reference category*

Religion

Religion was a significant predictor only in the model for malaria. The results show that women who do not have any religion have the highest odds of their children having malaria (75.9%) as compared to those in the Protestants and other Christians group. They are followed by Catholic women who have a 17.3% odds that their child will have malaria. On the other hand, Muslim women have relatively low odds, only 1.4% more than the Protestants and other Christians, of their children having malaria.

Ownership of Consumer Items

The ownership scale for consumer items was only significantly associated with diarrhea. The results as indicated by the odds ratio (.810) show that ownership of consumer items has a negative effect on the morbidity status of a woman's child. This suggests that as one's value on the ownership scale increases the odds that their child would suffer diarrhea decreases.

Occupation

Just as ownership of consumer items, a woman's occupation was only significantly correlated with diarrhea. The results show that except for women in skilled manual occupations(odds ratio=.965) belonging to the other occupation groups is associated with increased odds of a woman's child having diarrhea. Being in an unskilled manual occupation is associated with the highest odds of a woman's child having diarrhea (odds ratio=2.092). Results for the other groups show that being a professional is associated with an increased odds of a child suffering diarrhea of 23.6%, while being in clerical, sales and service occupations, and self-employed in agriculture increases the odds by 31.2% and 37.4% respectively. Overall, the results do not conform to the expected pattern of the disease-occupation relationship as they suggest that women who do not have any occupation (not working) have an improved morbidity status than those who are working.

DISCUSSION AND CONCLUSION

This analysis was premised on the hope that by studying morbidity differentials we might gain a better understanding of why certain social and economic groups in Kenya have high rates of infant and child mortality. However, the results have shown that except for the age of the mother, number of children living at home, marital status and region of residence, the other factors included in the analysis were significant in one or two models while others were not significant in any of the models.

The results show that women in different regions in Kenya vary in terms of the morbidity status of their children. For malaria and pneumonia, regional variation suggest that regions with higher incidences have certain ecological conditions associated with the aetiology of these ailments. Malaria was found to be more likely to occur among children of women in Western, Nyanza, Eastern and Coast regions. The ecological conditions associated with this heightened risk of suffering malaria invariably include low altitudes, large water bodies, and warm and humid climates. Except for Coast province, which is a lowland region, the likelihood of pneumonia is higher in other regions. This points to the high altitude climate conditions, mainly cold temperatures, associated with pneumonia. In addition to the ecological conditions, differential levels of social and economic development between the regions could account for the emerging morbidity status differences. These findings confirm Hill and Hill (1988) observation that regional mortality differences reflect the effects of certain regional-specific conditions such as climate, level of economic and social development, and also ecological factors associated with aetiologies of important diseases of childhood. Mott (1982) also found that areas in Kenya having excess mortality are not only economically disadvantaged but are also areas where malaria is prevalent. Central province for instance is considered more developed in terms of number of educated women, health facilities and higher economic development than other areas in Kenya. Western, Coast and Nyanza are not only malaria-prone areas, but they are relatively less developed. Eastern province is largely a semi-arid area and suffers recurrent droughts and famine, which means that many children in this region suffer malnutrition and are therefore more susceptible to illness. These factors could help explain the emerging morbidity, and ultimately, mortality difference between regions. These factors suggest that it is not just mere residence in a particular region area that determines the morbidity status of children.

The results also show that young ages of mothers and a higher number of children living at home are associated with higher odds of incidence of sickness among their children. The results are also consistent with the normal reproductive performance and life cycle pattern. At the very young ages most women would still be having children which means that many would have children below age three and hence are likely to constitute a majority of mothers whose children had malaria. As women approach the end of their child bearing age, fewer are having children and hence the number of children aged less than three years among this group is likely to be low, and hence the probability of these women reporting that their children had malaria would be low. It may also rightly be argued that women who are older are more experienced in child care and in spite of the number of children living at home being high, they take extra care of the young and hence their children would suffer less incidence of malaria. In addition, their other children might be older and do not share the same sleeping quarters with their parents and the young child, hence the likelihood of mosquitos passing malaria from one of these to the baby is reduced. On the other hand, younger women may be less experienced in child care and hence a large number of children in the household may further undermine their ability of giving proper care to their young children.

The results invariably show that children of single mothers have higher incidence of sickness as compared to those of married and once married women. The large difference between married and once married women in morbidity status of children on one hand, and that of unmarried women on the other suggests that the former live in relatively privileged situations than the latter. Again, unmarried women may be younger, hence pointing to biological factors, unemployed teenagers who have dropped out of school due to pregnancy, or women forced to leave work due to pregnancy, both cases indicating economic inability to take care of and provide for the child. The number of women also joining the labour force is increasing, as a result of structural and economic changes associated with the development process. These women have to choose between working and remaining at home to care for their children. Children of single working mothers are therefore likely not to receive proper care as mothers commit less time to child care when they go to work. In addition, they may not be able to afford to hire someone to care for their child and may be forced to leave the child under the care of an older child while away at work. These factors are likely to negatively impact on the health of the child.

Participation in the labour force, as indicated by women's occupation status, is a key institutional change associated with social and economic development. The results indicate that women in various occupations vary in the morbidity status of their children, particularly diarrhea. Occupation, however, depends on one's level of education and to some extent the results mirror the education- morbidity relationship observed above. It may also be related to other factors such as place or region of residence and therefore its effect on morbidity would be better modelled through other factors.

Although the results show that education is significant in predicting the morbidity status of a woman's child particularly malaria and diarrhea, the pattern of operation of education is not consistent. The interpretation of the results of the malaria model are difficult because all women of lesser than secondary or higher education have lower odds of their children suffering malaria. One of the arguments Caldwell (1979) posits in the education-mortality relationship is that, an educated woman's knowledge of the available medical facilities is likely to be superior and she will tend to use them correctly. In addition, unlike uneducated mothers they are more capable of demanding the attention of doctors when their children are sick. It may be argued therefore, that increasing education is associated with improved ability to identify and specify the nature of disease. This suggests that women of higher education not only give accurate report of the nature of sickness but report its incidence more than those of lower education groups. Although women with less than complete secondary and higher education have higher odds of their children suffering diarrhea, the effect of education is also not uniform as in the case of malaria.

An interesting observation made by demographers concerns the difference between the levels of child mortality among women of no education and those who have completed primary education. Women of no education, it is argued, are still practising traditional modes of child care such as prolonged breastfeeding which protect the child from childhood sickness including diarrhea while those who have completed primary education have abandoned these practices but have not yet fully accepted modern child care practices. The latter are also likely to adopt some practices that are harmful to the child's welfare due to their limited knowledge. One such practice is the over-reliance on bottle feed which is unaccompanied by sanitary food handling and general hygienic practices; and an aversion for breastfeeding which is regarded as outdated or 'uncivilised' (Plank and Milanesi, 1973; Huffman and Lamphere, 1984).

Morbidity levels, however, are likely to remain high among women with no or little education due to strong beliefs about cause and nature of sickness mainly mediated by religion. Religion is a good indicator of people's beliefs and practices about the nature, cause and response to disease. The results show that people who do not belong to any religion have very high odds of their children having malaria as compared to those belonging to any religion. Education is one of the factors that is likely to alter a people's attitudes toward the cause of disease; and also lead to adoption of alternative child care and therapeutics that become available in a modernising society (Caldwell, 1979). In relation to religion, it may be argued and it may be true, that the reason why many children of uneducated women die is because these women still hold beliefs about causes of sickness and death that are incompatible with modern medical science conception of causes of diseases. Children of such mothers die from easily preventable or treatable diseases because the mothers attribute the sickness to activities of witchcraft and supernatural forces. In the case of morbidity this means that these women do not take precautionary measures against disease as they attribute its causes to factors beyond their control. Women belonging to no religion and who have little or no education are likely to hold these beliefs that contradict modern medicine's conception of disease and its causes.

The results of this study on the relationship of education and morbidity underscore the potential problem associated with interpretations that ignore other factors through which education affects child morbidity or which also affect child morbidity and hence survival through education. Ware (1984), for instance, observed that maternal education acts as a proxy for command over resources such as shelter, clothing, food, sanitary facilities and good water supply. This is therefore an issue of household wealth. Educated women are themselves likely to have grown in wealthier homes, making it possible for them to go to school, and to live in wealthier homes, education serving as a mean to this wealth through access to employment or marriage to wealthier men. Ownership of consumer items was not linked to women's education in this analysis. However, the results show that children in wealthier homes, as indicated by ownership of consumer items, have less incidence of diarrhea than those from poorer homes. Rather than disproving the existence of a relationship between education and household resources, this analysis points to the need for a multifactoral analysis; one that would seek to determine the way education operates to affect child morbidity.

Literacy status just as education is likely to improve a mother's ability to comprehend health education information , and hence lead to abandonment of practices with deleterious effect on child's health. The results confirm the expectation that children of mothers who read with ease have lower incidence of malaria. It may be argued that literate mothers take preventive measures against malaria such as giving their children prophylaxis, and keeping a clean environment around the family house which includes clearing bushes and draining stationary water where mosquitos could breed. It may argued that the reason women who read with difficulty have higher odds of their child suffering malaria is that, although being able to read improves one's ability to identify a disease, little ability to read may lead to mis-classification of a disease. On the other hand, it may be rightly suggested that women who cannot read may still be using beneficial traditional preventive techniques against mosquitos and malaria, while those who read with difficulty are trying to divorce themselves from these methods, and at the same time have not fully accepted modern medical science preventive measures which again they may not understand well.

These results underscore the need for the government to rejuvenate the adult literacy programme which is likely to substantially benefit women in particular. This becomes more pertinent if it is considered that declining government expenditure in education due to the implementation of structural adjustment programmes (SAPs) in the past decade and a half, and the requirement that parents meet a greater portion of the cost of their children could have had a larger negative effect on the enrolment levels of female children. At least as far as child health is concerned what is needed is not eight or so years of formal education but rather the transmission of specific ideas and skills about child care practices (Trussell and Hammerlough, 1983), which requires only an ability to read and write. It is also not difficult to see that the cost of implementing a literacy programme are far less than those of providing formal education for most women who have not enrolled or dropped out school in the recent decades.

Kenya's media sector has experienced great growth over the years. As a consequence, there are many radio and television health programmes and also much health information provided in newspapers. This analysis however, has not established any convincing linkage between morbidity status and media use. These findings, however, do not imply that provision of health information is not important in disease prevention. On the contrary, the results suggest that information on listenership and viewership of specific health programmes together with readership of health education materials, should be sought in future surveys to gauge the effect of health information provision on morbidity.

The analysis did not find any significant relationship between morbidity and household environmental conditions. This is surprising because household environmental conditions particularly source of water and type of toilet facility have been found to be significant determinants of child survival (Anker and Knowles, 1983). It may be argued, however, that in countries like Kenya where a majority of the people live in rural areas or in poor urban areas environmental conditions are generally unfavourable. Asking women to report the type of toilet facility in the household or the source of drinking water may not be sufficient to capture such a multidimensional phenomena as environmental contamination. For instance, it is never asked how garbage is disposed in the household, yet this is an important factor in disease-environment interaction. In addition, other important disease mediating conditions such as food storage and preparation and general hygiene related practices are also never gathered in sample surveys such as the DHS. This suggests that a different measurement of the relationship of environmental conditions and child survival need to be sought. Nahar (1992), writing in relation to Bangladesh, argues that in a homogeneous society it is hard to identify any single sanitation factor which can capture the effects of environmental contamination. He suggests that an indicator scale with several covariates may be more informative. However, although this was attempted in this study the fact that no significant relationship was observed suggests that a search for an innovative manner to measure and model environmental conditions in morbidity studies is far from complete. It may be argued that when a disease is endemic as is the case with malaria in Kenya, or when environmental conditions are generally poor attempting to link household environmental conditions to morbidity may not yield the expected pattern of results due the multiplicity of factors involved.

The factors identified as significant in predicting the morbidity status of children have provided an indication of the direction health programmes could take. There is need for the government to continue efforts to increase greater availability of health services especially in rural areas. Such programmes as those emphasising benefits of better nutrition, particularly emphasising diversity and alternative foods, and a shift in over-reliance on ‘traditional foods’ and good hygiene as embodied in the Primary Health Care strategy also need to be strengthened . This is particularly important now because government expenditure on health care has substantially declined due to implementation of structural adjustment programmes(SAPs).

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