THE EFFECT OF SOME SOCIO-ECONOMIC FACTORS ON INFANT AND CHILD MORTALITY IN TANZANIA: A CASE STUDY OF TANGA REGION

BY

AHMED MOHAMED MAKBEL

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF ARTS (DEMOGRAPHY) IN THE
UNIVERSITY OF DAR ES SALAAM

JULY, 1997

ABSTRACT

This study investigates the effect of some socio-economic factors on infant and child mortality in Tanzania. The findings are based on the data collected from a sample of 1678 households consisting of 7036 members residing in Tanga Region by means of a retrospective sample survey conducted between September and October 1996.

This study was inspired by the fact that despite heavy investments in the health sector by the donors and the government, the rate of mortality decline remained below that needed to achieve the country's targets by the turn of the century. Infant and child mortality contributes a substantial proportion of the mortality in the country, a reduction of which will accelerate the overall decline. Since there is a limit to which the mortality decline will take place in the absence of socio-economic development, some factors were thus considered for analysis. The factors include: the education and occupation of the mother and the household head; household income, expenditure and assets; accessibility to health facilities and services; availability of water for domestic use and type of toilet used by the household.

The main objective of the study was to establish the relationship between these factors and child mortality in the region. From the analysis, the factors that showed the strongest influence on child mortality were type of toilet, source of water, maternal education and annual household expenditure. The child mortality decreases with an increase in maternal education and annual expenditure which is also a close proxy of income. Households using flush toilets experienced the lowest child mortality followed by those using pit latrine and lastly by those with no toilet. Domestic water from wells was found to be associated with lower child mortality compared to those using water from taps and rivers.

On the other hand, place of residence, maternal and head's occupation, and annual household income depicted some correlations with child mortality but not as strong as the previous factors. All the findings explained above were in line with the anticipated direction of influence. However, the education of head was surprisingly found to be positively correlated with child mortality. It seems that the highly educated heads are too busy to participate in child care.

towns especially at the district headquarters where it is also incomplete.

Due to these deficiencies in mortality statistics, methods were developed to provide better estimates. On the other hand, "it is well known that the proportion of children ever born who have died are indicators of child mortality and can yield robust estimates of childhood mortality" (United Nations, 1983 p. 73). Brass was the first to develop a procedure for converting proportions dead of children ever born reported by women in age group 15-19, 20-24, etc into estimates of the probability of dying before attaining certain exact childhood ages (ibid.).

The main assumptions of the Brass method are that fertility and childhood mortality have remained constant in the recent past. According to Kpedekpo (1982), the Brass method is based on the following assumptions:-

a) infant and child mortality rates have remained constant in the recent past

b) the omission rates of dead children and of surviving children are about the same as in the reported numbers ever born

c) there is no powerful association between the age of the mother and infant mortality or between death rates of mothers and their children

d) the age specific fertility schedule has remained constant in the recent past and the schedule is known

e) the age pattern of mortality among infants and children conforms approximately to the model life tables

Sullivan and Trussel made some modifications to the original Brass method. The basic data needed for the Brass method are the number of children ever born, the number of children surviving (or dead) and the total number of women classified in five year age groups.

Mturi (1991), in the analysis of infant and childhood mortality of the 1988 population census noted that the modifications by Trussel seems to apply to the prevailing situation in many developing countries and thus it has been adopted in Tanzania. This study also utilizes the Trussel version of the Brass method for computing the infant and under five mortality rates both overall and for different levels of analysis variables. As described in

United Nations (1983), the technique for estimating IMR and U5MR is carried out through five steps outlined below:-

Step 1: Calculation of average parity per woman for each age group, P(i).

P(i)=CEB(i)/FP(i)

where,

i is 1,2,3,...,7 denoting the five year age groups 15-19, 20-24,25-29, ..., and 45-49 respectively;

CEB(i) denotes the number of children ever born by women in age group i; and

FP(i) is the number of female population in age group i.

Step 2: Calculation of proportion of children dead, for each age group of women, D(i).

D(i)=CD(i)/CEB(i)

where,

CD(i) is the number of children dead reported by women in age group i; and

CEB(i) is as defined before.

Step 3: Calculation of multipliers, k(i) needed to adjust the reported proportion dead D(i) for the effect of the age pattern of child bearing.

k(i)=a(i)+b(i)P(1)/P(2)+c(i)P(2)/P(3)

where,

a(i), b(i) and c(i) are coefficients provided by Trussel (as given in United Nations, 1983 p.77 Table 47). A different set of coefficients is provided for each of the four different families of Coale-Demeny Model Life Table system; and P(1), P(2) and P(3) are average parities for women in age groups 15-19, 20-24 and 25-29 respectively as calculated in step 1 above.

Step 4: Calculation of probabilities of dying and surviving at/to exact age x, q(x) and l(x) respectively.

q(x)=k(i)D(i) and l(x)=1-q(x)

where,

x denotes the mean age of the children of women in age i, and the value of x is not necessarily equal to that of i;

x is 1,2,3,5,10,15 and 20 for age group i=1,2,3,4,5,6 and 7 respectively; and

k(i) and D(i) are as defined before.

Step 5: Calculation of reference period, t(x).

t(x)=a(i)+b(i)P(1)/P(2)+c(i)P(2)/P(3)

where,

a(i), b(i) and c(i) are coefficients provided by Trussel (United Nations, 1983 p.78 Table 48). As in step 3, these coefficients are also provided for each of the four different families of Coale-Demeny Model Life Table system;

t(x) refers to an estimate of number of years before the survey date to which the estimate q(x) refers when mortality is changing smoothly.

The choice of which family of the Coale-Demeny Life Table system to use is determined by matching the known parameters (recorded or estimated) of study population with those printed for each stable population in the system. The parameters include growth rate (ranging from -0.010 to 0.050), the birth rate, the death rate, the rate of increase, gross and net reproduction rates (ranging from 0.800 to 6.000). There are four families namely North, East, South and West each having 26 levels to choose from (Brass et al., 1968 p.113, 121, 123, 125). If the fertility and mortality levels of a population have not changed markedly in recent past as assumed by the method, then its age pattern of mortality will conform very closely to that of the stable population matched against.

According to Brass et al. (ibid. p. 113) "there are indications (not wholly conclusive) that the pattern of mortality in infancy and childhood in the North family of the model life tables fits African experience better than does that of the West family. The relevant distinctive feature of North mortality is that infant mortality is relatively low and childhood mortality (above age 1) relatively high. This characteristic matches what many observers (and some specific studies) have reported about African populations."

In Tanzania quite a number of studies have adopted the North family. Sembajwe (1983) and Mturi and Rubona (1994) have found this family most suitable for Tanzania when analyzing the 1978 and 1988 population censuses respectively. The 1991/92 TDHS also adopted the North family for estimation of infant and childhood mortality (Bureau of statistics, 1994 p.73). Mohani (1992) also found that the North family was appropriate for Tanzania using data from the 1967 and 1978 censuses. Furthermore, Mbago (1994) used data on children ever born and children surviving from the 1967, 1978 and 1988 censuses and found that North family corresponds to the mortality pattern of the country.

After determining the family the next step is to determine the level(s) that conform with the computed l(x). This is done by identifying the level(s) where the computed l(2) falls. If it falls exactly or very close to a certain level then the life table l_x's of that level corresponding to ages 1, 2, 3, 5, 10, 15 and 20 are taken as representing the l(x)'s of the study population. If the average of the probabilities of surviving falls between two levels, then the exact life table level and its corresponding l_x's are computed using linear interpolation as outlined below.

Let,

l(2) be the survivorship probabilities for age group 20-24,

l_{xl} and l_{xh} be the life table l_x's for the low and high levels respectively where l(2) falls between,

L be the exact level to be interpolated

L_l and L_h be the low and high levels respectively where l(2) falls between, and

l_x^* be the life table survivorship probabilities for the interpolated level L of the life table,

then,

$$(L-L_l)/(L_h-L_l) = (l(2)-l_{xl})/(l_{xh}-l_{xl})$$, and thus

$$L = (L_h-L_l)(l(2)-l_{xl})/(l_{xh}-l_{xl}) + L_l$$, and

$$l_x^* = (L-L_l)(l_{xh}-l_{xl})/(L_h-L_l) + l_{xl}$$

From the l_x^*'s, the probabilities of dying at exact age a, q(a) are computed as

$$q(a) = 1-l_a^*$$

where q(1) and q(5) are taken as estimating the IMR and U5MR respectively.

A demographic computer package LOTPAK has been designed to perform all the computations above once the family of the model life table has been determined. This package was utilized when computing estimates of infant and childhood mortality for the 1988 population census of Tanzania. This study utilized the same package for estimation of the IMR and U5MR for different categories of the independent variables. The rates were calculated as an average of implied IMR and U5MR for women in age groups 20-24 and 25-29 respectively.

Regression Analyses:

In the hypotheses it has been conjectured that there is a relationship between infant and childhood mortality and some socio-economic variables namely mother's education, mother's occupation, household income and availability of water. Moreover, the first two objectives of this study demand correlation and regression analyses both simple and multiple. On the other hand, the IMR and U5MR estimated using the Trussel version of the Brass method are based on the whole study population or its subpopulation. The following two regression models were considered in this study.

Ordinary Least Squares Regression for MORT:

To perform the analysis mentioned above, an indication of the childhood mortality risks at individual (woman) level is needed which has to be expressed as a function of the socio-economic variables, that is:-

$MORT_h$ = f(EDUC,OCCUP,ANINC,RESID,OTHERS)

where,

$MORT_h$ is the mortality indicator for woman h

EDUC are the education level of the mother and the head of household

OCCUP are the occupation of the mother and the head of household

ANINC is the annual household income

RESID is the place of residence either urban, semi-urban or rural.

OTHERS are the variables in the research including the type of house, household size, fuels for cooking and lighting, value of assets, annual household expenditure, type of toilet, source of water and average time spent to fetch water per day.

This study assumed a linear relationship between the mortality indicator MORT (dependent variable) and the socio-economic variables which are taken as independent.

Since data on children ever born and children dead are available for each woman, then the proportion of children dead for the woman may provide a basis for the computation of the indicator (United Nations, 1983 p. 73). However, women in different age groups experience different mortality risks for their children due to different lengths of the exposure. This calls for standardization of the proportions by age group of the mother. This is done by dividing the observed proportion dead for the woman to the expected proportion dead of the woman's age group (exposure group). This is similar to dividing the observed children dead by the expected children dead as outlined in Mohani (1992).

Mohani (ibid.) used the 1967 and 1978 population census data to come up with the expected proportion dead. Mbago (1994) used the 1967, 1978 and the 1988 census data to come up with the expected (standard) proportions dead. This study utilized the 1988 population census data to come up with the standard proportions dead for each age group. Thus, the mortality indicator for each woman was computed as follows:-

$$MORT_h = (OD)_h(i) / (ED)_{1988}(i)$$

where,

$(OD)_h(i)$ = $(CD_h(i)/CEB_h(i)$ is the observed proportion of children dead for woman h in exposure group i;

$(ED)_{1988}(i)$ = $CD_{1988}(i)/CEB_{1988}(i)$ is the expected proportion of children dead for a woman in exposure group i assuming that her children's mortality conformed to the national level derived from the 1988 Population Census data;

$CD_h(i)$ is the observed number of children dead for a woman h in exposure group i in the study population who has given at least one live birth;

$CEB_h(i)$ is the observed number of children ever born for a woman h in exposure group i in the study population who has given at least one live birth, i.e. $CEB_h > 0$;

CD_{1988}(i) is the expected mean number of children dead for a woman in exposure group i in 1988 Population Census;

CEB_{1988}(i) is the expected mean number of children ever born for a woman in exposure group i in the 1988 Population Census

This indicator takes positive values only, with an average value of 1 when the observed and expected proportion of children dead are equal. The values of the indicator are assumed to be normally distributed.

The basic equation of the model is:

$$MORT_h = a + \sum_k b_{jk} X_{jk} + e$$

where,

$MORT_h$ is the mortality indicator of woman h;

a is the regression constant (y-intercept);

b_{jk} is the regression coefficient of category j of independent variable k (slope of the regression line);

X_{jk} is value of category j of independent variable k;

e is the residual/error term;

k is the number of independent variables

When k is equal to 1, the equation is used for simple correlation and regression analysis of each independent variable against the mortality indicator. When k is more than 1, the equation is used to measure the combined effect of k independent variables against the mortality indicator. MORT is a continuous variable while all the independent variables are categorical including the income whereby it is categorized into income ranges. Indicator (dummy) variables were assigned to each category of the independent variables. The reference categories were excluded from the equations by assigning a zero value for their dummy variables. The SPSS for Windows 6.01 package was used for this analysis.

Since the mortality indicator is a continuous variable, it had a large number of values unsuitable for tabulation. To avoid this problem, the values of the indicator were broadly categorized as follows for cross tabulation purpose:-

$0 <= MORT_h < 1 ==> 1$

$1 <= MORT_h < 2 ==> 2$

$2 <= MORT_h < 3 ==> 3$

$3 <= MORT_h < 4 ==> 4$

$4 <= MORT_h ==> 5$

Logistic Regression for CDEATH:

The dependent variable CDEATH is a dichotomous variable with a value of 1 for a woman who has experienced a child death, and 0 for the one who hasn't experienced a child death. As done in Mbago (1994) the following model was fitted:-

$$\log(p/(1-p)) = \beta_0 + \sum_{i=1}^{k} \beta_i x_i$$

where,

p is the probability of a mother having at least one child death;

x_1, x_2, ..., x_k are the different risk factors;

β_0, β_1, ..., β_k are the respective parameters to be estimated.

In this model, two equations were used to investigate the effects of two sets of socio-economic variables on the dependent variable. Variables included for each equation are given below:-

Equation 1: Maternal education, annual household expenditure and place of residence.

Equation 2: Type of toilet and source of water were added to those already in equation 1. These were considered as community variables.

Analysis for the Mortality Regression Models:

Selection of variables to be included in the model was based on the Pearson Chi-Square test of correlation and multiple regression procedures. After determining which variables should go into the models, correlation and regression analysis of the independent variables against the dependent variables followed. To start with, each independent variable was analyzed separately against the dependent variables to measure its individual effect. Later, their combined effect was measured by including all of them in the regression equations.

3.6 Summary

In this chapter we have discussed the geographical, social, economic and demographic characteristics of the study area. We also discussed the methods and approaches used for data collection. Later on we showed how the reliability of the collected data was checked. Lastly we explained how the data was analyzed using the regression models adopted.

Table 4.1: Distribution of Study Population By Age and Sex

	SEX				Table Total	
	Male		Female		Col %	Count
	Col %	Count	Col %	Count		
AGE GROUP						
0-4	14.2%	481	11.9%	436	13.0%	917
5-9	15.7%	533	14.0%	511	14.8%	1044
10-14	13.7%	464	14.1%	515	13.9%	979
15-19	9.8%	333	10.6%	385	10.2%	718
20-24	6.7%	226	10.4%	379	8.6%	605
25-29	6.6%	222	8.5%	311	7.6%	533
30-34	5.2%	175	7.5%	273	6.4%	448
35-39	5.9%	201	4.7%	172	5.3%	373
40-44	4.1%	140	4.0%	145	4.1%	285
45-49	4.0%	135	3.1%	112	3.5%	247
50-54	3.9%	131	2.8%	101	3.3%	232
55-59	2.2%	76	1.9%	68	2.0%	144
60-64	2.3%	79	2.3%	85	2.3%	164
65+	5.5%	187	4.3%	156	4.9%	343
Not Stated	.1%	4	.0%	0	.1%	4
Table Total	100.0%	3387	100.0%	3649	100.0%	7036

Source: Study on Infant and Child Mortality
in Tanga Region September 1996, MCH-JICA

Residence:

In this study, place of residence was divided into three categories namely urban, semi-urban and rural. The urban category covered households in Tanga town while the semi-urban consisted of households in Pongwe ward. The rural category included households from Kirare, Magoma and Kizara wards. Of the 7036 persons enumerated in this study, about 11 percent were residing in the urban, 46 percent living in the semi-urban and 43 percent were from the rural areas.

Maternal Occupation:

After examination of frequencies of the categories, this variable was recategorized into 'Office/Technical', 'Trading', 'Agricultural', 'Household duties/Other' and 'Not employed' categories. The data reveal that IMR and U5MR are lowest for women involved in household duties such as housewives and those helping with domestic duties. The second lowest rates are for those women working in offices or having technical jobs such as teachers, secretaries, nurses, administrators, clerks, machine operators, etc. The rates are highest for women without any sort of employment followed by those engaged in agriculture. Similar results were established by Mturi and Rubona (ibid, p. 110) for the 1988 population census. The rates referring approximately to the year 1994 are shown in Table 4.3 below:-

Table 4.3 Infant and Under-Five Mortality Rates By Occupation of the Mother.

Occupation	IMR	U5MR
Household Duties/Other	95	154
Office/Technical	99	161
Trading	109	182
Agricultural	131	220
Not Employed	167	280

increase and fall as the value increases. On the other hand, the rates fall with the increase in annual household expenditure with a slight fluctuation between the highest three categories. The upper boundaries of the expenditure ranges were based on the average expenditures of below 1000/=, 2000/=, 3000/= and 4000/= per day which were set arbitrarily. The mortality rates for different expenditure ranges are depicted in Table 4.5 below:-

Table 4.5 Infant and Under-Five Mortality Rates By Annual Expenditure of the Household.

Annual household expenditure	IMR	U5MR
TShs. 0/= - 360,000/=	208	346
TShs. 360,001/= - 720,000/=	116	193
TShs. 720,001/= - 1,080,000/=	106	176
TShs. 1,080,001/= - 1,440,000/=	109	181
TShs. 1,440,001/= -	102	168

4.4.3 Household Head Education and Occupation

Head's Education:

This also showed a decrease of the mortality rates as the education level of the household head increases. However, the decrease in mortality was smaller compared to that of maternal education especially between 'adult/primary' and 'secondary' levels. This may lure somebody to conclude that maternal education has more influence on infant and child mortality than that of head of household (or husband). The rates referring to 1994 are given in Table 4.6 below:-

Table 4.6 Infant and Under-Five Mortality Rates By Education Level of the Head of Household.

Head's Education Level	IMR	U5MR
No Education	164	276
Adult/Primary	120	201
Secondary	118	194

Head's Occupation:

Like the maternal occupation, the rates increase with the departure from household duties to those engaged in agriculture. They then fall slightly between agriculture and not employed. Nonetheless, the rates for all occupation categories of the head except the 'agricultural' are lower than those recorded for maternal occupation. This may suggest that the occupation of head other than agriculture has more effect than that of the mother. These rates are given in Table 4.7 below:-

Table 4.7 Infant and Under-Five Mortality Rates By Occupation of the Head of Household.

Household Head Occupation	IMR	U5MR
Household Duties/Other	68	107
Office/Technical	90	146
Trading	106	175
Agricultural	141	239
Not Employed	138	227

4.4.4 Household Residence, Toilet and Water

Place of Residence:

As mentioned earlier, place of residence was divided into urban, semi-urban and rural categories. Estimated IMR and U5MR reveal that the rates increase as you move from urban to the remote rural areas. The figures show that the rates in rural areas are more than twice those found in urban centres. The summary of the rates referring to approximately the year 1994 is given in Table 4.8 below:-

Table 4.8 Infant and Under-Five Mortality Rates By Place of Residence of the Household.

Place of Residence	IMR	U5MR
Urban	69	109
Semi-Urban	97	158
Rural	167	281

Type of Toilet:

This variable showed a remarkable effect on the mortality rates. Since a human being has to dispose his wastes somewhere, the category 'no toilet' may be taken to imply the bush. Therefore we can say that the rates fall with the use of modern toilet facilities. The results show that the rates for those with no toilet are twice as high as those using flush toilets. The computed IMR and U5MR against the type of toilet used by the household are given in Table 4.9 below:-

Table 4.9 Infant and Under-Five Mortality Rates By Type of Toilet Used by the Household.

Type of Toilet	IMR	U5MR
No Toilet	170	286
Pit Latrine	117	196
Flush Toilet	85	137

Source and Time to Fetch Water:

Despite being included to see the workload of women, the mortality rates did not show any pattern with an increase in time spent. The time spent to fetch water per day may imply the shortage of water and/or long distance to the source. The minimum rates were found for those who spent between 1 and 1.5 hours (IMR=78 and U5MR=125) while the and expected proportions of children dead are equal. The value greater than one indicates that the observed proportion of children dead is greater than the expected proportion. The values of expected proportion dead used are shown in Tables 4.10a and 4.10b below.

Table 4.10a: Women (15-49 years) By Five Year Age Groups, Children Ever Born, Children Dead and Proportion Dead in Tanga, 1996.

Age (years)	Number of Women	Children Ever born	Children dead	Proportion dead
15-19	381	79	10	0.1266
20-24	378	475	75	0.1579
25-29	307	790	151	0.1911
30-34	273	1125	201	0.1787
35-39	173	960	171	0.1781
40-44	144	991	142	0.1433
45-49	112	802	139	0.1733

Source: The Study on Infant and Child Mortality in Tanga Region, September 1996 - MCH JICA.

Table 4.10b: Women (15-49 years) By Five Year Age Groups, Children Ever Born, Children Dead and Proportion Dead in Tanzania, 1988.

Age (years)	Number of Women	Children Ever born	Children dead	Proportion dead
15-19	1,301,730	407,373	61,223	0.1503
20-24	1,051,543	1,633,146	258,325	0.1582
25-29	954,565	3,010,507	507,074	0.1684
30-34	654,862	3,120,085	569,061	0.1824
35-39	563,771	3,295,727	649,109	0.1970
40-44	422,849	2,704,674	606,623	0.2243
45-49	366,763	2,374,250	581,955	0.2451

Source: Bureau of Statistics (1994b): 1988 Population Census: Fertility and Mortality Data, Tanzania.

Despite being highly acclaimed for analysing child mortality, the variable MORT has its shortcomings as quoted in Mohani (1992):-

i) MORT may be expected to be lower for higher status than for lower status women, not because of lower underlying mortality risks, but because of shorter exposure to such risks. Thus, regression analysis would give an exaggerated estimate of the reduction in child mortality associated with indicators of higher socio-economic status especially in this case where data are classified by age of a woman.

different directions in different age ranges.

4.5.2 Mortality Indicator (MORT) and Some Socio-Economic Variables

The analysis of IMR and U5MR against the independent variables above was based on the mortality experience of all women in the age group regardless of whether they have ever given birth or not. The analysis of MORT against the variables goes a step further in considering the individual mortality experience of only the women who have ever given birth. Nonetheless, these experiences are later averaged for the women in the same independent variable's category to get the average MORT. The frequencies of different MORT levels are given in Table 4.11 below:-

Table 4.11: Women (15-49 years) By MORT Value.

MORT VALUE	Frequency	Percent	Valid Percent	Cum Percent
0.00-0.99	922	52.1	72.8	72.8
1.00-1.99	190	10.7	15.0	87.8
2.00-2.99	104	5.9	8.2	96.1
3.00-3.99	15	.8	1.2	97.2
4.00-	35	2.0	2.8	100.0
Missing	502	28.4		
Total	**1768**	**100.0**	**100.0**	
Valid cases	1266	**Missing cases**	502	

Note: For some variables the valid cases may be less than 1266 because of non-response to these variables.

In the following sections the variation of the average MORT value against categories of some of the independent variables will be discussed.

MORT and Maternal Education:

The average MORT values decreased with the increase in the education of the mother. This coincides with the analysis of IMR and U5MR against maternal education discussed earlier. Mohani (1992) and Bakari (1990) established similar results in Dodoma and Mbeya respectively. A Pearson Chi-Square test showed that the variables were significantly dependent at 0.004 percent. The values of average MORT against the education level of the mother and the number of women in that level are depicted in Table 4.12 below:-

Table 4.12: Women (15-49 years) By Education Level By Average MORT Value

Maternal Education	Average MORT	Number of women
No Education	.73	252
Adult/Primary	.59	909
Secondary	.23	100
ALL	.59	1261

Table 4.13: Women (15-49 years) By Type of Occupation By Average MORT Value

Maternal Occupation	Average MORT	Number of women
Office/Technical	.31	115
HH Duties/Others	.46	226
Trading	.62	146
Agricultural	.66	687
Not Employed	.69	87
ALL	.59	1261

MORT and Annual Household Income:

The average MORT values for the women living in households earning not more than TShs. 100,000/= per year were the highest among the income levels. After this income level, the MORT values decrease with the increase of the income. Since the introduction of user charges to social services such as education and health, income has become an important factor in obtaining such services.

For example, one can get free consultation services from the government health facility, but s/he has to buy the Sammenfaller medication prescribed. The findings concur with Sembajwe (1973) predictions that even the mortality advantage of the urban may be offset by, among other things, the hazards to health and inadequate incomes resulting from uncontrolled migration from rural to urban. It is now a common feature for government health facilities to have frequent shortage of medicines. It was found in this study that about 75 percent of the sampled households were not satisfied with services at the government health facilities due to frequent shortage of medicine.

This implies that either people have no money or are unwilling to buy medicines. However, we have seen that about 10 percent of study households use private hospitals as their usual place of treatment. Thus, one can conclude that the most important factor here is lack of money (income) and so those with low income become more exposed to mortality causes. The variation of income with MORT is shown in Table 4.14 below:-

Table 4.14: Women (15-49 years) By Annual Household Income By Average MORT Value

Annual Household Income	Average MORT	Number of Women
TShs. 0/=- 50,000/=	.67	284
TShs. 50,001/=-100,000/=	.73	239
TShs. 100,001/=-300,000/=	.60	328
TShs. 300,001/=-500,000/=	.45	199
TShs. 500,001/=+	.39	207
ALL	.58	1257

MORT and Place of Residence:

The results show that there is not much difference between the urban and semi-urban areas in the MORT levels. This

Table 4.15: Women (15-49 years) By Place of Residence By Average MORT Value

Place of Residence	Average MORT	Number of Women
Urban	.45	164
Semi-Urban	.48	561
Rural	.75	541
ALL	.59	1266

MORT and Type of Toilet:

As mentioned earlier, children are more susceptible to diseases. On the other hand, poor disposal of human waste increases the risk of environmental contamination and hence disease transmission. Thus, the type of toilet facilities used has implications for the hygienic and mortality conditions of the household and the whole community.

The data show that MORT decreases with the increase in the quality of the toilet used. Control of disease spreading agents such as flies is higher in flush toilets than in pit latrine and where there is none but the bush. Furthermore, Pant (1991) remarks that the flush toilets act as an indicator of better household socio-economic status, suggesting access to better services and care for children. The results are shown in Table 4.16 below:-

Table 4.16: Women (15-49 years) By Type of Toilet Used By Average MORT Value

Type of Toilet	Average MORT	Number of Women
No Toilet	.99	139
Pit Latrine	.55	1091
Flush Toilet	.16	35
ALL	.59	1265

MORT and Source of Water for Domestic Use:

It is not surprising to find that tap and river/lake/dam water is associated with higher MORT levels. In the actual sense, tap water in Tanga mostly comes from the river water. The river water is continuously contaminated all along the way it passes. Contamination is reduced by chemical treatment of the water at the reservoirs before pumped to the taps. However, this does not eliminate the risk of disease transmission completely.

On the other hand, contamination of well water regardless of whether the wells are protected or not is minimal. The community using these wells prevents them from animal, human and other contamination agents. Some of them are found in their farms or backyards of their homes. This explains why MORT is lower for those women using well water than other sources as shown in Table 4.17 below:-

Table 4.17: Women (15-49 years) By Source of Domestic Water By Average MORT Value

Source of Water	Average MORT	Number of Women
Protected Well	.48	244
Unprotected well	.53	305
Tap	.60	583
River/Lake/Dam	.89	133
ALL	.59	1265

4.6 Regression Analysis

As mentioned earlier, ordinary least squares and logistic regression approaches were used to examine the effects of the selected socio-economic variables on the infant and child mortality. However, before carrying out any further analyses, tests were made to determine if there were any relationships between the socio-economic variables and the dependent variables. This was done with the help of the computer package (SPSS for Windows 6.01) where various statistical tests were applied.

The first step done was the univariate analysis of each of the independent variables against the dependent variable. The Pearson's Chi-Square tests were made to determine the association between each independent variable and the dependent variable. The variables that were found to have significant association (at 0.05 level or less) with the matrices, the variables that were selected for the bivariate regression analyses were correlated with the dependent variables at the 0.05 significance level. Moreover, the categories of independent variables which had more women (children ever born) were designated as reference categories. These variables and their categories (with reference categories indicated by an asterisk) are given in Table 4.18 below:-

Table 4.18: Variables Used for Regression Analysis.

Variable	Categories
Maternal Education Level	
	1. No Education
	2. Adult/Primary *
	3. Secondary
Maternal Occupation	
	1. Office/Technical
	2. Household Duties/Other
	3. Trading
	4. Agricultural *
	5. Not Employed
Education Level of Head	
	1. No Education
	2. Adult/Primary *
	3. Secondary
Occupation of Head	
	1. Office/Technical
	2. Household Duties/Other
	3. Trading
	4. Agricultural *
	5. Not Employed

Table 4.18: (continues)

Variable	Categories
Annual Household Income	
	1. TShs. 0 - 100,000/= *
	2. TShs. 100,001/= - 300,000/=
	3. TShs. 300,001/= - 500,000/=
	4. TShs. 500,001/= -
Annual Household Expenditure	
	1. TShs. 0 - 360,000/=
	2. TShs. 360,001/= - 720,000/= *
	3. TShs. 720,001/= - 1,080,000/=
	4. TShs. 1,080,001/= - 1,440,000/=
	5. TShs. 1,440,001/= -
Place of Residence	
	1. Urban
	2. Semi-Urban *
	3. Rural
Type of Toilet	
	1. No Toilet
	2. Pit Latrine *
	3. Flush
Source of Domestic Water	
	1. Protected Well
	2. Unprotected well
	3. Tap *
	4. River/Lake/Dam

In order to build up the model for the multivariate regression analyses, further selection of the variables was to be made. According to Hosmer Jr. and Lemeshow (1989), any variable whose univariate test has a significance level of less than 0.25 should be considered as a candidate for the multivariate model along with all

4.6.1 Ordinary Least Squares Regression (OLS)

Bivariate OLS Regression Analysis:

In this analysis, the dependent variable, MORT was examined against each of the independent variables, one at a time, using 'ordinary least squares' method. The indicator variables of the independent variable's categories were used in the analysis. The signs and values of regression coefficients were examined to see if they varied with different directions from the reference category. The F tests for lack of dependence (i.e. $ß_k=0$) were found to be significant below the 0.05 level. This implies that there were significant dependencies between the dependent and the independent variables. The results of the bivariate regression analysis (using SPSS for Windows 6.01) are given in Table 4.19 below:-

Table 4.19: Results From Bivariate OLS Regression Analysis For MORT

Variable	Regression Coefficient (B)	Standard Error (SE B)
Maternal Education:	(Signif F = 0.0001)	
No Education	0.144969*	0.067596
Adult/Primary	Reference	
Secondary	-0.355249***	0.100035
(Constant)	0.589470	0.031492

Table 4.19: (continues)

Variable	Regression Coefficient (B)	Standard Error (SE B)
Maternal Occupation:	(Signif F = 0.0006)	
Office/Technical	-0.356322*	0.095745
Household Duties/Other	-0.203295**	0.072872
Trading	-0.045138	0.086601
Agricultural	Reference	
Not Employed	0.031748	0.108140
(Constant)	0.662236	0.036256
Education of Head:	(Signif F = 0.0076)	
No Education	0.064960	0.075887
Adult/Primary	Reference	
Secondary	-0.250547**	0.087805
(Constant)	0.608227	0.031145
Occupation of Head:		(Signif F = 0.0002)
Office/Technical	-0.269195***	0.066208
Household Duties/Other	-0.142091	0.173967
Trading	-0.052171	0.084424
Agricultural	Reference	
Not Employed	0.235747	0.139956
(Constant)	0.651418	0.034637
Annual Household Income:		(Signif F = 0.0001)
0/= - 100,000/=	Reference	
100,001/= - 300,000/=	-0.102708	0.066213
300,001/= - 500,000/=	-0.246683**	0.078299
500,001/= -	-0.307615***	0.077195
(Constant)	0.700294	0.041107

Table 4.19: (continues)

Variable	Regression Coefficient (B)	Standard Error (SE B)
Annual Household Expenditure:	(Signif F = 0.0000)	
0/= - 360,000/=	0.321242***	0.081095
360,001/= - 720,000/=	Reference	
720,001/= - 1,080,000/=	-0.081581	0.075085
1,080,001/=-1,440,000/=	0.017946	0.087823
1,440,001/= -	-0.167940*	0.078115
(Constant)	0.583568	0.044054
Place of Residence:	(Signif F = 0.0000)	
Urban	-0.032551	0.084028
Semi-Urban	Reference	
Rural	0.270711***	0.057039
(Constant)	0.479157	0.039965
Type of Toilet:	(Signif F = 0.0000)	
No Toilet	0.431439***	0.085034
Pit Latrine	Reference	
Flush	-0.396189*	0.162143
(Constant)	0.554207	0.028574
Source of Water:	(Signif F = 0.0005)	
Protected Well	-0.118160	0.072434
Unprotected Well	-0.074344	0.067131
Tap	Reference	
River/Lake/Dam	0.291546**	0.091296
(Constant)	0.600679	0.039321

Significant at: * 0.05, ** 0.01, *** 0.001 level.

The results from the final multivariate OLS regression equation including the five independent variables and MORT are given in Table 4.20 below:-

Table 4.20: Results From the Final Multivariate OLS Regression Analysis For MORT

Variable and categories	B	SE (B)	Sig. T
Maternal Education:	(p=0.0490)		
No Education	.078881	.069170	.2543
Adult/Primary	REFERENCE		
Secondary	-.237713	.111697	.0335
Annual Household Expenditure:	(p=0.0070)		
0/= - 360,000/=	.256482	.083315	.0021
360,001/= - 720,000/=	REFERENCE		
720,001/= - 1,080,000/=	-.022105	.075059	.7684
1,080,001/= - 1,440,000/=	.057565	.086758	.5071
1,440,001/= -	-.096124	.079051	.2242
Place of Residence:	(p=0.3032)		
Urban	.077601	.100545	.4404
Semi-Urban	REFERENCE		
Rural	.114751	.063408	.0706
Type of Toilet:	(p=0.0000)		
No Toilet	.369438	.087508	.0000
Pit Latrine	REFERENCE		
Flush	-.209412	.178464	.2409
Source of Domestic Water:	(p=0.0039)		
Protected Well	-.135812	.075756	.0733
Unprotected Well	-.126815	.071148	.0749
Tap	REFERENCE		
River/Lake/Dam	.220973	.100651	.0283
(Constant)	.501900	.069612	.0000

Table 4.21: Results From Bivariate Logistic Regression Analysis For CDEATH

Variable	Coefficient	Standard Error	Odds Ratio
Maternal Education:		(p = 0.0000)	
No Education	0.5452***	0.1444	1.7249
Adult/Primary	Reference		1.0000
Secondary	-1.0564***	0.2749	0.3477
Intercept	-0.5291	0.0687	
Model Chi-Square	37.109	(p=0.0000)	
Degrees of Freedom	2		
Number of Cases	1257		
Maternal Occupation:		(p = 0.0000)	
Office/Technical	-0.9235***	0.2331	0.3971
Hhold Duties/Other	-0.6926***	0.1671	0.5003
Trading	-0.2455	0.1873	0.7823
Agricultural	Reference		1.0000
Not Employed	-0.0431	0.2301	0.9578
Intercept	-0.2580	0.0770	
Model Chi-Square	30.981	(p=0.0000)	
Degrees of Freedom	4		
Number of Cases	1260		
Education of Head:		(p = 0.0053)	
No Education	0.0433	0.1622	1.0442
Adult/Primary	Reference		1.0000
Secondary	-0.6619**	0.2092	0.5159
Intercept	-0.4269	0.0668	
Model Chi-Square	11.361	(p=0.0034)	
Degrees of Freedom	2		
Number of Cases	1262		

Table 4.21: (continues)

Variable	Coefficient	Standard Error	Odds Ratio
Occupation of Head:			(p = 0.0244)
Office/Technical	-0.4507**	0.1491	0.6372
Hhold Duties/Other	-0.3640	0.3913	0.6949
Trading	-0.0733	0.1823	0.9256
Agricultural	Reference		1.0000
Not Employed	0.2552	0.2957	1.2907
Intercept	-0.3778	0.0743	
Model Chi-Square	11.513	(p=0.0214)	
Degrees of Freedom	4		
Number of Cases	1265		
Annual Household Income:		(p = 0.0085)	
0-100,000/=	Reference		1.0000
100,001-300,000/=	-0.0833	0.1434	0.9200
300,001-500,000/=	-0.4679**	0.1769	0.6263
500,001/=-	-0.4565**	0.1740	0.6355
Intercept	-0.3247	0.0887	
Model Chi-Square	11.936	(p=0.0076)	
Degrees of Freedom	3		
Number of Cases	1256		

Table 4.21: (continues)

Variable	Coefficient	Standard Error	Odds Ratio
Annual Household Expenditure:		(p = 0.0077)	
0-360,000/=	0.5468**	0.1737	1.7278
360,001-720,000/=	Reference		1.0000
720,001-1,080,000/=	-0.1032	0.1664	0.9020
1,080,001-1,440,000/=	0.0600	0.1916	1.0619
1,440,001/=-	-0.0569	0.1723	0.9447
Intercept	-0.5468	0.0967	
Model Chi-Square	13.801	(p=0.0080)	
Degrees of Freedom	4		
Number of Cases	1265		
Place of Residence:		(p = 0.0000)	
Urban	-0.2835	0.1953	0.7531
Semi-Urban	Reference		1.0000
Rural	0.4769***	0.1241	1.6110
Intercept	-0.6585	0.0891	
Model Chi-Square	23.383	(p=0.0000)	
Degrees of Freedom	2		
Number of Cases	1265		
Type of Toilet:		(p = 0.0000)	
No Toilet	0.7855***	0.1818	2.1286
Pit Latrine	Reference		1.0000
Flush	-1.5066**	0.5345	0.2217
Intercept	-0.5388	0.0628	
Model Chi-Square	30.314	(p=0.0000)	
Degrees of Freedom	2		
Number of Cases	1265		

Table 4.21: (continues)

Variable	Coefficient	Standard Error	Odds Ratio
Source of Water:		(p = 0.0032)	
Protected Well	-0.2732	0.1621	0.7609
Unprotected Well	0.0403	0.1453	1.0412
Tap	Reference		1.0000
River/Lake/Dam	0.5459**	0.1934	1.7261
Intercept	-0.5008	0.0854	
Model Chi-Square	13.897	(p=0.0030)	
Degrees of Freedom	3		
Number of Cases	1265		

Significant at: * 0.05, ** 0.01, *** 0.001 level.

Multivariate Logistic Regression:

As mentioned earlier, two equations were constructed for this model. Despite being significant at 0.05 level in the first equation, place of residence was found to have insignificant effect in the second equation. Maternal education, type of toilet and source of water were found to be significant in both equations. The significance levels of the annual household expenditure was all above the 0.05 level. The results of the multivariate logistic regression are shown in Table 4.22 below:-

Table 4.22: Results From Multivariate Logistic Regression Analysis For CDEATH

Equation		(1)			(2)	
Variable	Coeff.	SE	OR	Coeff.	SE	OR
Socio-Economic Variables:						
Maternal Education:	(p = 0.0001)			(p = 0.0001)		
No Education	0.4271**	0.1516	1.5328	0.4886**	0.1542	1.6301
Adult/Primary	Reference		1.0000	Reference		1.0000
Secondary	-0.9197**	0.2979	0.3986	-0.8108**	0.3026	0.4445
Annual Household Expenditure:	(p = 0.2223)			(p = 0.5057)		
0-360,000/=	0.3938*	0.1780	1.4825	0.2920	0.1870	1.3390
360,001-720,000/=	Reference		1.0000	Reference		1.0000
720,001-1,080,000/=	-0.0164	0.1713	0.9838	-0.0403	0.1753	0.9605
1,080,001-1,440,000/=	0.1505	0.1959	1.1624	0.1350	0.1984	1.1448
1,440,001/=-	0.0890	0.1794	1.0930	0.0930	0.1827	1.0975
Place of Residence:	(p = 0.0189)			(p = 0.4560)		
Urban	0.0477	0.2153	1.0489	0.0503	0.2341	1.0516
Semi-Urban	Reference		1.0000	Reference		1.0000
Rural	0.3559**	0.1288	1.4274	0.1799	0.1438	1.1971
Community Variables:						
Type of Toilet:				(p = 0.0015)		
No Toilet				0.6188**	0.1954	1.8567
Pit Latrine				Reference		1.0000
Flush				-0.9847	0.5715	0.3735
Source of Water:					(p = 0.0083)	
Protected Well				-0.4484*	0.1758	0.6386
Unprotected Well				-0.1392	0.1616	0.8700
Tap				Reference		1.0000
River/Lake/Dam				0.3143	0.2230	1.3693
Intercept	-0.7709***	0.1287		-0.6586***	0.1580	
Model Chi-Square	51.608 (p=0.0000)			75.963 (p=0.0000)		
Degrees of Freedom	8			13		
Number of Cases	1255			1255		

Significant at: * 0.05, ** 0.01, *** 0.001 level.

Coeff. = Coefficient, SE = Standard Error of the coefficient, OR = Odds Ratio

CHAPTER FIVE

5 CONCLUSION, SUGGESTIONS AND RECOMMENDATIONS

5.1 Introduction

After presentation and analysis of data, this chapter relates the findings to the hypotheses and research questions proposed for this study. In line with the conclusions on the hypotheses, suggestions and recommendations will be given to all the concerned parties to rectify the situation. The suggestions and recommendations will consider practical applicability and sustainability at both the community and governmental level.

5.2 Conclusions

This study had four hypotheses and seven research questions. This section highlights the conclusions reached regarding each of the hypotheses and questions. The conclusions are based on the analysis of the data and discussion of the findings in chapter four. The conclusions for each of the proposed hypotheses and research questions are given below:-

a) **Hypothesis One:** "Maternal Education is inversely related to infant and childhood mortality".

We have seen that the levels of IMR and U5MR decreased with the increase of maternal education. Furthermore, the regression analysis proved that the variable was significantly and negatively associated with child mortality. These findings point to the conclusion that the hypothesis is accepted.

b) **Hypothesis Two:** "Maternal Occupation influences infant and childhood mortality".

Children of mothers engaged in white collar jobs and household domestic activities were found to have low levels of IMR and U5MR compared to those engaged in agriculture and those without any employment. Statistical analysis of the data gave similar results. The variable was found to be significantly correlated with child mortality. On the basis of these findings, the proposed hypothesis is therefore accepted.

c) **Hypothesis Three:** "Household Income is inversely related to infant and childhood mortality".

Variations of the IMR and U5MR with the level of household income were in the postulated direction. In the statistical analysis of data, the variable showed significant relationship with child mortality only in bivariate regressions. When other variables were included in the model, its significance diminished. However, the household expenditure which is sometimes used as its proxy showed significant and negative association with child mortality. Considering the limitations of income data in many developing countries, it is reasonable to use this proxy as a reliable estimate of household income. It is thus logical to conclude that child mortality decreases with the increase in annual household income. Hence, based on the findings and this argument, the hypothesis is accepted.

d) **Hypothesis Four:** "Place of Residence influences infant and childhood mortality".

The analysis of the data has shown that the levels of infant and child mortality decrease when one moves from the rural to urban when other independent variables are not controlled for. The significance of the variable is lost when the type of toilet and source of domestic water are considered in the multivariate regressions. This shows that the urban advantage over rural in child mortality is embedded in factors other than the mere locality of the household. However, the statistical evidence and the association argued earlier between this variable and the two community variables, have provided the basis for accepting the hypothesis.

e) **Research Question One:** "Does the education of household head influence infant and childhood mortality?".

The education of the head of household has shown a clear relationship with child mortality only in the logistic regression. The levels of IMR and U5MR did not show great differences between those heads with adult/primary education and those with secondary education. These findings suggest that the influence of education of the head of household on child mortality is remote. This is not surprising since most of the household heads are the bread winners of their households and so spend little time with their young children. Even the female heads may leave the care of their children to their older children, relatives or house girls. In this way the education of the head depends on whether these caretakers of their children follow their health, nutrition and sanitation instructions or not.

f) **Research Question Two:** "Does the occupation of household head influence infant and childhood mortality?"

The levels of IMR and U5MR and the bivariate regressions have shown that child mortality is lowest for household heads engaged in household duties and in office/technical jobs. On the other hand child mortality was found to be the highest for household heads engaged in agriculture or those who are unemployed. The occupation of the head has also shown strong correlation with the household annual income. Since expenditure is sometimes used as a proxy for income, we can then argue that the occupation of head is indirectly related to expenditure. From these assumptions we can conclude that the occupation of head has a direct as well as an indirect influence (through expenditure) on child mortality.

g) **Research Question Three:** "Does the value of assets owned by household influence infant and childhood mortality?"

In this study we did not find any pattern between the levels of IMR and U5MR and the value of assets owned by the household. This differs from the anticipation that ownership of assets contributes to the economic status of the household. However, we must admit that the estimation of current values for assets such as fields/crops, livestock, self-made assets like furniture and houses, and those assets bought long time ago was difficult and may have contributed to this lack of pattern.

h) **Research Question Four:** "Does the annual household expenditure influence infant and childhood mortality?"

Despite minor fluctuations, the findings from this study have shown that child mortality decreases with an increase in annual household expenditure. With the exception of multivariate logistic regression, the variable was found to be significantly (at 0.05 level) and negatively associated with child mortality in all the other regressions. The conversion of this variable from continuous into categorical variable may have caused loss of some information during the regressions.

i) **Research Question Five:** "Does the type of toilet used by household influence infant and childhood mortality?"

This study has demonstrated that the type of toilet used by the household has strong influence on child mortality. The levels of IMR and U5MR for those households with no toilet are about twice those having flush toilets. Furthermore, in all the four regressions the variable has displayed a consistent and strong association with child mortality. This emphasizes the need to dispose human waste properly to prevent the children from risks posed by this waste.

j) **Research Question Six:** "Does the source of drinking water normally used by household influence infant and childhood mortality?"

As for the type of toilet, the source of domestic water used by the household exhibited a strong connection with child mortality. Water from the rivers and taps (which is more likely to be contaminated) is strongly related to higher levels of child mortality compared to that obtained from the wells. One may assume that tap water is safe but this study has shown otherwise. There may be two underlying reasons for this source to be affiliated with higher child mortality. One of the reasons may be that the levels of treating are not sufficient to make it safe. The other reason may be its irregular availability which may force those relying on this source to use it in quantities below those needed for hygienic and sanitation purposes.

k) **Research Question Seven:** "Does the time taken to fetch drinking water influence infant and childhood mortality?"

Fetching of water is one of the activities that the rural and even the urban mother is expected to carry out besides other activities. The current scarcity of water experienced in many parts of the country increases the workload of the mothers who have to spend more time to fetch water. However, the levels of IMR and U5MR found from the study were not in the expected direction. For example, the levels of IMR and U5MR for the mothers who spent between 1 and 1.5 hours were 78 and 125 respectively. On the other hand, the levels for those who spent between half an hour and one hour were 147 and 249 respectively. It was due to these findings that the variable was dropped from further analysis. Poor reporting of time or overlapping of activities may have contributed to these findings. Time budgeting is one of the weakest point for many people especially in the rural areas where more than one activity may be performed simultaneously. Therefore, this study has failed to show any relationship between the time spent to fetch water and child mortality.

From the discussion above, we can conclude that our research data has led to the acceptance of all the four hypotheses. Furthermore, the findings from the analysis have also shown that of the seven variables in the research questions, only two (value of assets and time to fetch water) have failed to show any clear relationship with child mortality.

5.3 Suggestions and Recommendations

In this section, suggestions and recommendations will be given for each of the independent variables included in the hypotheses and research questions. General advice and considerations will also be given based on the findings and observations made during the whole course of the study. The ideas and views expressed by the community during the feedback meetings will also be considered