THE EFFECT OF AGE OF MOTHER AND PARITY ON INFANT MORTALITY
A CASE STUDY OF MBEYA REGION

BY

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A B S T R A C T

The main focus of this study is on the effect of age of mother and parity on infant mortality. These are maternal factors. The study was extended to the effect of birth interval and intervention of socio-economic factors in the maternal factors on infant mortality.

The major hypotheses of the study are these; lower and higher ages of mother have high infant mortality. Also, first parities and higher birth orders (fifth and above) have high infant mortality. Further, short birth intervals between two successive births and poor socio-economic development intensifies the effect of the maternal factors on infant mortality.

Chapter one is the introductory part of the study, which focus on the background of the study, objectives, significance and literature review of the study.

The survey area and the methodology of the study constitutes chapter two. In this chapter, the geography of the area, data collection procedures, limitations of the study and data analysis techniques are outlined.

In chapter three, an attempt is made to show the effect of the maternal factors on infant mortality. Also, social economic intervention in the maternal factors was observed and revealed to be strongest in the rural area.

Chapter four contains the summary of the findings of the study. Recommendations as to what can be done to reduce the level of infant mortality is also outlined.

Table 1.5.3: Age-Specific Death Rates per 1000 Live Births by Birth Order of Child

(a) For All Women

Order of Child	Total Births	Under 1 month	1-11 Months	Under 12 Months	12-59 Months	Under 60 Months
1	1180	44.1	20.3	64.4	24.6	89.0
2-3	1843	39.6	32.0	71.6	28.8	100.4
4-6	1600	41.3	31.9	73.1	32.5	105.6
7+	532	77.1	33.8	110.9	33.8	144.7

(b) For Women Aged 20-24 at Birth of Children

1	178	39.3	11.2	50.6	22.5	73.0
2-3	144	62.5	13.9	76.4	13.9	90.0
4-6	23	130.4	87.0	217.4	0	217.4
7+	0	0	0	0	0	0

(c) For Women Aged 25-29 at Birth of Children

1	256	46.9	23.4	70.3	7.8	78.1
2-3	393	50.9	33.1	84.0	35.6	119.6
4-6	173	40.5	40.5	80.9	28.9	109.8
7+	12	83.3	83.3	166.7	83.3	250.0

(d) For Women Aged 30-34 at Birth of Children

1	158	19.0	19.0	38.0	25.3	63.3
2-3	284	17.6	14.1	31.7	24.6	56.3
4-6	217	18.4	23.0	41.5	23.0	64.5
7+	29	69.0	34.5	103.4	0	103.4

Source: A paper presented to an International Workshop on Perinatal and Infant Mortality in Arusha, Tanzania, August 17-20, 1987 by P. Namfua.

On the other hand, the results reveal that children born to women aged 20-24 and 25-29 years, mortality rises as the birth order rises. The]-shaped relationship is observed only in the age group 30-34.

Table 2.4: The Distribution of Wards in Mbeya District According to Residential Categproes

RESIDENTIAL CATEGORY	W A R D S	POPULATION
High Density	*Rujewa	37,417
	Utengule/Usangu	29,875
	Utengule/Usangwe	23,023
	* Iwindi	21,487
	Tembela	20,765
	Ruanda	20,162
Medium Density	Ruiwa	19,556
	Mawindi	17,728
	Madebira	17,728
	* Ulenje	16,626
	* Ilembo	15,933
	Igale	15,481
	Chimala	15,183
	Isuito	15,137
	Santilya	14,953
	Ilomba	13,109
	Sinde	12,004
	Iyunga	11,836
	Mapogoro	10,111
	Mzonvwe	10,037
Low Density	Isanga	9,959
	Mbalizi Road	9,678
	Iwiji	8,692
	* Mabatini	8,134
	* Majengo	9,292
	Mshewe	8,170
	Nonde	7,868
	Ihango	7,815
	Ijombe/Ntangano	7,387
	Igawilo	7,199
	Uyole	6,436
	Msanga	5,355
	Maendeleo	5,015
	* Itezi	4,983
	Sisimba	4,835
	Itemi	4,505
	Ikukwa	4,079
	Iziwa	2,627
	Itende	2,421
	Mwansekwa	1,863
	Mwansanga	831

Source: Population Census. Preliminary Report (1988).

* Ward Surveyed.

(ii) Cumulation of Data

Advantages over the single year age data:

The single year age data indicated that there were preferences and avoidance of certain ages. Ages which end with the digit 0 and 5 were most favoured while those ending with the digit 3, 7 and 9 were in many cases avoided. For example, examination of the data obtained from the Rujewa ward respondents showed the following terminal-digit preference (See Table 2.6.4).

Table 2.6.4. (a): Terminal Digit Preference as shown by The Rujewa Ward Respondents

DIGIT	NUMBER OF RESPONDENTS	PERCENTAGE
0	29	17.1
1	13	7.6
2	19	11.2
3	7	4.1
4	13	7.6
5	33	19.4
6	14	8.2
7	9	5.3
8	22	12.9
9	11	6.5
TOTAL	170	99.9

Table 2.6.4*(b)*: Respondents classified in the Five Year Age Groups for Rural and Urban Residences

RESI-DENCE	U R B AN				R U R A L			
Age of Respon-dent	Number of Respo-ndent	Number of Child-ren ever-born	Number of Dead child-ren	Number of Deaths at in-fancy	Number of Respo-ndent	Number of Child-ren ever-born	Number of Dead child-ren	Number of Deaths at in-fancy
1	2	3	4	5	6	7	8	9
15-19	80	66	21	9	125	118	46	24
20-24	96	224	49	13	112	205	62	26
25-29	103	249	56	12	146	414	98	27
30-34	58	241	52	14	90	422	98	33
35-39	56	239	54	15	105	598	131	46
40-44	32	177	44	15	50	294	73	28
45-49	39	165	42	14	50	314	103	32
50+	34	238	46	12	46	330	136	30
TOTAL	488	1599	364	104	724	2695	747	246

Source: Computed from the Survey Data.

(iii) Omission of Livebirths

The recording of the number of livebirths which automatically affects the reporting of the number of children who died during infancy to each respondent can be distorted by both over and under-reporting, though over reporting is rare. Underreporting of births is believed to

(ii) then, of the children who died before completing one year, what was (were) their birth order(s), that is, 1,2,3,.....

These two questions explored dead infants and their respective birth orders (parities).

Responses for the two hypotheses were recorded as shown in Table 3.3.1.

Table 3.3.1: The Effect of Age of Mother and Parity on Infant Mortality

1	2	3	4	5	6	7	8	9
Age of Respon-dents (in eight year intervals)	Number of Respondents	Number of Children Everborn (CEB)	Number of Dead Children	Number of Deaths During Infancy	Proportion of Children Deaths During Infancy	Parity 1	Parity 2-4	Parity 5+
<20	212	195	71	35	0.179	25	10	-
20-27	332	820	188	76	0.093	26	22	28
28-35	305	1162	264	63	0.054	21	17	25
36-43	193	1046	244	93	0.089	28	30	35
above 43	108	589	182	42	0.071	-	18	24
Total	1150	3812	949	309	n.a.	100	97	112

Note: n.a. = not applicable

Source: Calculated from the survey data.

This was the first hypothesis and to justify it a coefficient of correlation (r) was computed using the data given in Table 3.3.2. In this case, age of mother (in ages 20, 23.5, 31.5, 39.5 and 43) are denoted by X (independent variables) and infant mortality is denoted by Y (dependent variables).

Table 3.3.2: Age of Mother and Infant Mortality

Age of Mother "X"	Deaths of Infants "Y"	XY	X^2	Y2
20.0	35	700	400	1225
23.5	76	1786	552.25	5776
31.5	63	1984.5	992.25	3969
39.5	93	3673.5	1560.25	8649
43.0	42	1806	1849	1764
157.5	309	9950	5353.75	21383

Source: Computed from the Survey Data.

where

$$r = \frac{n\Sigma XY - \Sigma X \Sigma Y}{\sqrt{[n\Sigma X^2 - (\Sigma X)^2][n\Sigma Y^2 - (\Sigma Y)^2]}}$$

$$= \frac{(5 \times 9950) - (157.5 \times 309)}{\sqrt{[5 \times 5353.75) - 24806.25][5 \times 21383 - 95481]}}$$

infant deaths. The outcome therefore, tallies with the documented findings outlined in Chapter One. That is, lack of experience in parity one and exhaustion of mothers' stock in childbearing in higher parities, in combination with other factors which influence infant mortality, form the major explanation for the causes of death to children at early stage of life.

3.3.3 The Measure of Birth Interval and Survival of Children

The period (in months) between two successive births by a particular woman was recorded as shown in Table 3.3.3 below.

Table 3.3.3: The Effect of Birth Interval on Infant Mortality

Birth Interval (in maths)	Number of Respondents (Mothers)	Number of Children Everborn	Average Number of Children Everborn	Number of Deaths to children	Number of Deaths at Infancy	Proportion of Deaths at Infancy
<24	313	1219	3.9	459	99	0.0812
24-35	387	2144	5.5	360	150	0.069
36-47	263	392	1.5	93	32	0.082
>48	110	57	0.5	27	12	0.2105

Source: Computed from the Survey Data

Table 3.3.4: Infant Mortality by Age Groups and Place of Residence

	URBAN					RURAL				
1	2	3	4	5	6	7	8	9	10	11
Age of Respondents	Number of Respondents	Number of Children Everborn	Number of Dead Children	Number of Deaths at Infancy	Proportion Dead at Infancy	Number of Respondents	Number of children Everborn	Number of Dead Children	Number of Deaths at Infancy	Proportion Dead at Infancy
15-19	80	66	21	9	0.12	125	118	46	24	0.20
20-24	96	224	49	13	0.06	112	205	62	26	0.13
25-29	103	249	56	12	0.05	146	414	98	27	0.07
30-34	58	241	52	14	0.06	90	422	98	33	0.08
35-39	56	239	54	15	0.06	105	598	131	46	0.08
40-44	32	177	44	15	0.08	50	294	73	28	0.10
45-49	29	165	42	14	0.08	50	314	103	32	0.10
50+	34	238	46	12	0.05	46	330	136	30	0.10
Total	488	1599	364	104	0.56	724	2695	747	246	0.86
Mean	n.a	n.a	n.a	n.a	0.07	n.a	n.a	n.a	n.a	0.11

n.a. = not applicable

Source: Computed from the Survey Data

Table 3.4:ESTIMATIONS OF INFANT AND CHILDHOOD MORTALITY LEVELS BY TRUSSELL'S METHOD-MBEYA REGION

	MBEYA RURAL PLUS URBAN			MBEYA URBAN DISTRICT			MBEYA RURAL DISTRICT		
Age Interval of the children	Multiplying Factors where $P_1/P2=0.382$ $P_2/P_3=0.883$	Estimated Proportion Dead q(x)	North Model Mortality Level	Multiplying Factors where $P_1/P2=0.354$ $P_2/P_3=0.964$	Estimated Proportion Dead q(x)	North Model Morta-lity Level	Multiplying Factors where $P_1/P2=0.399$ $P_2/P_3=0.834$	Estimated Proportion Dead q(x)	North Model Morta-lity level
	KI	qx=KIDI		KI	qx=KIDI		KI	qx=KIDI	
1	2	3	4	5	6	7	8	9	10
1	0.7449	0.2712	3.7	0.8950	0.2848	3.2	0.6528	0.2545	4.5
2	0.7349	0.1654	11.9	0.7310	0.1599	12.3	0.7362	0.1718	11.5
3	0.7492	0.1745	12.6	0.7064	0.1589	13.4	0.7835	0.1855	12.0
5	0.8212	0.1857	13.3	0.7676	0.1656	14.3	0.8541	0.1727	13.9
10	0.8995	0.1988	13.9	0.8400	0.1898	14.4	0.9357	0.2050	13.7
15	0.9034	0.2244	13.5	0.8470	0.2110	14.1	0.9375	0.2325	13.2
20	0.9020	0.2730	12.4	0.8546	0.2180	14.4	0.9307	0.3053	11.2

After getting the multiplying factors, qx were derived as follows:

qx = KiDi.

The summary results shown in Tables 3.4 indicates that the risk of a child dying is not only a function of the age of the child. It appears that, mothers age, birth order of the child and small numbers in an age group affect the results of the first age group. The results for this age group indicate higher levels of infant mortality than those

suggested by qx values at older ages (q_2, q_3 and q_5). This is contrary to the ideal expectation of higher life expectancy at a younger age than at an older one which would reflect declining mortality. This observation has been made by many other researchers such as W. Brass et al, "Demography of Tropical Africa" and I.S.L. Sembajwe's "Analysis of Rural-Urban Differentials in Fertility and Child Mortality in Tanzania."

Expectation of life at birth implied by lx values from older women is based on events which took place far in the past. These women are therefore likely to suffer from memory lapse and/or underreporting caused by involuntary suppression of information related to death in many African communities, and to be unrepresentative of current mortality conditions or mortality conditions in the recent past.

With regard to child mortality, the final level of mortality reflecting health conditions in childhood was made by getting the mean expectations of life at birth implied in the appropriate level of the Coale and Demeny model life tables, North family, by l_2, l_3 and l_5. This procedure smooths the effect on the three lx values which were earlier noted to have some fluctuations. This yield the appendices 4(a), 4(b) and 4(c) which represent mortality levels for Mbeya (rural plus urban), Mbeya urban and Mbeya rural respectively. The infant mortality rate

for each category was calculated as follows:

(a) Mbeya (Rural plus Urban).

The mean level for l_2, l_3 and l_5 was found to be 12.6. In the North family of the Coale and Demeny Model life tables, infant mortality was calculated as follows:

(i) level 12

Females: 117.48

Males : 138.04

(ii) level 13

Females: 106.30

Males: 124.71

Taking $\frac{100}{205}$ and $\frac{105}{205}$ for female and male rations respectively, calculation proceeded as follows:

(iii) $(\frac{100}{205} \times 117.4) + (\frac{105}{205} \times 138.04) = 128.01$ x

(iv) $(\frac{100}{205} \times 106.03) + (\frac{105}{205} \times 124.71) = 115.60$ Y

(v) combination of x and y by the equation $(\frac{y-x}{10} \times 6) + x$

gave the average infant mortality level, which is 120.7. Therefore, infant mortality for Mbeya region was found to be 120.7. This means that to every 1,000 livebirths, 120.7 deaths occur during the first year of life.

(b) Mbeya Rural

The mean level for l_2, l_3 and l_5 was 12.5 (contrary to 12.6 for Mbeya rural plus urban). Therefore, substitutions in the equation $(\frac{y-x}{5} \times 5) + x$ gave 121.8 average infant

mortality rate for Mbeya rural. That is, 121.8 deaths to every livebirths during infancy stage.

(c) **Mbeya Urban**

The mean level for l_2, l_3 and l_5 was 13.3. In the North Family of the Coale and Demeny Model Life Tables, infant mortality was obtained through the following procedure:

(i) level 13	(ii) level 14
Females: 106.02	Females: 95.59
Males: 124.71	Males: 112.91

Therefore,

$$\left(\frac{100}{205} \times 106.02\right) + \left(\frac{105}{205} \times 124.71\right) = 115.6 \quad x$$

and

$$\left(\frac{100}{205} \times 95.59\right) + \left(\frac{105}{205} \times 112.91\right) = 104.46 \quad y$$

Substitutions in the equation $\frac{(y - x)}{10} \times 3$ gave 112.3 average infant mortality rate for Mbeya urban.

To conclude, infant mortality rate for:

Mbeya region (urban and rural) =120.7

Mbeya rural =121.8

Mbeya urban =112.3.

It may be noted that the value of infant mortality rate for Mbeya (urban plus rural) district does not differ much from that of Mbeya rural district. This is because, during sampling, rural population was favoured. Also, the survey general outlook revealed higher level of infant deaths in the rural residence than in the urban.

The difference in infant mortality rates between rural and urban districts reflects social economic differentials which pertain in most parts of Tanzanian rural and urban areas. In the analysis of 1967 Population Census, it was found that one child out of every six children born die within the first year of life. The analysis further shows that, regional variations in mortality in Tanzania is high and life expectancy at birth varies from 33 to 53 extremes. In these extreme cases, 20% as compared to less than 10% of the children die during their first year.

These differences can be taken as indicators in socio-economic standards between parts of Tanzania (Egero and Henin, 1973).

CHAPTER FOUR

4.0 SUMMARY AND RECOMMENDATIONS

4.1 Introduction

This study was promoted by the need to study the causes of high infant mortality in Tanzania. This is because very few studies have been conducted focusing on the same subject. So far, there are no documented studies in Tanzania which attempt to show the intervention of socio-economic factors with the maternal factors (that is age of mother, parity and birth interval) on infant mortality.

First, the effect of each factor on infant mortality was examined independently. Second, rural and urban socio-economic factors were taken to show their intensifying effect on each factor.

The outcome of the findings shows that urban residence, which represents relatively developed socio-economic factors have low infant mortality. Rural residence on the other hand, with low level of socio-economic development indicates relatively very high infant mortality. Most parts of the surveyed rural areas, like Ilembo and Ulenje wards, can be classified as being among

the least developed by one criterion or another. For instance, health services and transport network to these wards were very poor. But the urban area and parts of Rujewa, which is a mixed type ward, showed high level of socio-economic development, particularly in health services and transportation.

4.2. Summary of the Findings

4.2.1. The Measurement of Infant Mortality by Age of Mother

The measurement of infant mortality by age of mother at the time of death of the child, (Table 3.3.1), shows that, ages below 20 years have high infant mortality. This is because, 17.9% of the deaths of children born to mothers of age group < 20 years occurs during the infancy stage. Contrary to this high percentage, only 9.3% and 5.4% infant deaths occur to children born by mothers of age groups 20-27 an 28-35 years respectively. It was further found that children born to mothers of more than 35 years have high risk of dying during the infancy stage. Table 3.3.1 shows that 8.9% of the children born to mothers who are aged more than 35 years die during infancy, while in the preceding age group, only 5.4% of deaths to children are of infants.

The survey also discovered that mothers of ages below 20 years have low income on the average (below Tshs. 3,000), and in many cases, were dependants to their families. With low level of socio-economic development which was observed in the survey area, together with the low age at birth of their children, it is true that the maternal factors which are associated with infant deaths such as immature reproductive organs, lack of experience and ignorance in hospital services, particularly during delivery, intensify the risk of deaths to the children.

Age boundaries between 20-35 years show significantly low level of infant mortality, that is, 9.3% and 5.4% (for 20-27 and 28-35 years respectively as compared to 17.9% of ages below 20 years. Also, it was found that age group between 20-35 years have high fertility per woman (that is, 2.5 and 3.8 for ages 20-27 and 28-35 years respectively). On the other hand, mothers of ages less than 20 years showed 0.9 fertility rate, value which would be expected to have very low infant mortality rate. Therefore, low infant mortality rate to the age group 20-35 years indicates that problems which probably were the main cause of children deaths in the lower ages of mothers have diminished and the respondents have gained experience in childbearing.

On the other hand, ages of mothers above 35 years were observed to have high infant mortality. Although memory lapse in this age group tended to distort the quality of the data, the method used in analyzing mortality to children revealed high risk of deaths at their early stage of life (See Table 3.3.1).

In conclusion, the findings which regard age of mother and infant mortality tallies with the documented findings which were outlined in chapter one.

4.2.2. The Measurement of Infant Mortality by Parity

Infant mortality, when measured by parity of the dead children (see Table 3.3.1) shows that first born children and children of higher birth orders, that is, orders five and above, is high. On the other hand, parities 2-4 have low infant mortality on the average.

It is customarily observed that in Tanzania, many deliveries take place at home particularly in the rural area. For instance, respondents in the rural area (e.g. the Ilembo ward) reported that there were a few Traditional Birth Attendants (TBA's) who, in their absence, their role was taken over by old mothers who were thought of being

experienced in child bearing. However, in both cases, delivery was successful only where there were no major problems like operations and serious medical attention. In many cases, there was loss of the child and sometimes the mother.

It was seen in the Literature Review that first parities are associated with many factors which can lead to the death of the children (and sometimes the mothers). These include lack of experience in childbearing and some biological and physiological complications to some mothers. When these problems are combined with low age at childbearing and poor socio-economic factors, may lead into infant mortality.

Deaths to children of orders 2-4 are fewer (that is 97 out of 309 infant deaths) as compared to those in the first parity (100 out of 309), but still high on the average. On the other hand, deaths to children born in the higher birth orders are the highest, that is, 112 out of 309 infant deaths. In this case, exhaustion of the mothers' ability in childbearing, depletion in family resources and development of physiological weaknesses in the mothers' reproductive organs, when intensified by poor socio-economic factors are responsible for high infant mortality to higher parities.

4.2.3. The Measurement of Infant Mortality by Birth Interval

The high fertility which characterises the norms and values of many Tanzanian traditions causes short intervals between births. Birth intervals of at most 24 months between two successive births was reported as common, particularly in the rural area (see Table 3.3.3). Consequently, children who were reported dead during infancy were the victims of this short birth intervals. Table 3.3.3 shows that, of the 293 infant deaths which were measured by birth interval, 249 were of birth intervals ranging from 18 to 35 months. However, a birth interval of 24 months was reported as common by many respondents. Children born after a normal birth interval, that is, a birth interval ranging between 24-36 months, have less infant mortality. This group shows the least proportion dead during infancy, that is 0.069 out of 360 children deaths. It was further observed that there was more infant mortality for children born after a period longer than normal length of birth interval, that is, more than 48 months. In this category, of the 27 children deaths, 0.2105 is the proportion dead during infancy.

It may be concluded that short birth intervals do not allow the mothers to recuperate fully from the damages of

the previous births. Also, short birth intervals result into having many children within a short period. Therefore, with low level of socio-economic development, it becomes difficult to care for the children and thus increases risk of death. On the other hand, birth intervals longer than normal, have biological and/or physiological problems which may result into children deaths.

4.2.4 The Measurement of Infant Mortality by Socio-Economic Factors

The urban residence, with relatively developed socio-economic facilities have lower infant mortality. When Trussell's model was used in the estimation of infant mortality in Mbeya rural and urban areas, it was found that the rural area had 121.8% infant mortality rate as compared to 112.3% of the urban area. This means that for every 1,000 livebirths in the rural area, 121.8 die during infancy. On the other hand, 112.3 of every 1,000 livebirths in the urban area die at infancy stage.

The difference in the two values confirms that poor socio-economic factors in the rural area intensify the effect of the maternal factors on infant mortality.

4.3 Recommendations

The following policy implications emerge from the findings of this study.

(a) The results bring out the importance of ages of childbearing. A rise in the age of childbearing that is, above 20 years, and avoidance of ages above 35 years should be encouraged by every means in the Tanzanian society. This may be the strongest method which can reduce infant mortality in Tanzania. However, this may not be an easy task as it is likely to be accompanied by major changes in norms and values leading to a reduction of fertility in those ages. Consequently, reduction in infant mortality will be realized.

Since childbearing at these ages is still deeply rooted in many tribes of Tanzania, implementation of this policy may encounter a lot of difficulties. However, increase and enhancement in women education may have a positive effect on ages of childbearing. This, will reduce fertility in the ages below 20 years

and therefore, infant mortality. On the other hand, educated women tend to drop off fertility at higher ages (Swalehe, 1988), therefore, infant mortality which are associated to those ages will also drop.

It therefore becomes imperative that younger women, the potential for determining future generation, must be given more education as an alternative to early marriage and early childbearing.

(b) Delivery of first and fifth and above birth orders should take place in hospitals with more specialized personnel in child delivery. This can combat any risk of death which may be both to the child and the mother.

However, implementation of this policy may encounter a number of difficulties. Many deliveries particularly in the rural area take place at home. To discourage this character, home delivery should strictly be condemned. Instead, the Maternal and Child Health Centres (MCH), be intensified as the primary instrument

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First, the effect of each factor on infant mortality was examined independently. Second, rural and urban socio-economic factors were taken to show their intensifying effect on each factor.

The outcome of the findings shows that urban residence, which represents relatively developed socio-economic factors have low infant mortality. Rural residence on the other hand, with low level of socio-economic development indicates relatively very high infant mortality. Most parts of the surveyed rural areas, like Ilembo and Ulenje wards, can be classified as being among

Variables:
× health services
× transport network

the least developed by one criterion or another. For instance, health services and transport network to these wards were very poor. But the urban area and parts of Rujewa, which is a mixed type ward, showed high level of socio-economic development, particularly in health services and transportation.

4.2. Summary of the Findings

4.2.1. The Measurement of Infant Mortality by Age of Mother

Mothers age
≤20
= high IMR

The measurement of infant mortality by age of mother at the time of death of the child, (Table 3.3.1), shows that, ages below 20 years have high infant mortality. This is because, 17.9% of the deaths of children born to mothers of age group < 20 years occurs during the infancy stage. Contrary to this high percentage, only 9.3% and 5.4% infant deaths occur to children born by mothers of age groups 20-27 an 28-35 years respectively. It was further found that children born to mothers of more than 35 years have high risk of dying during the infancy stage. Table 3.3.1 shows that 8.9% of the children born to mothers who are aged more than 35 years die during infancy, while in the preceding age group, only 5.4% of deaths to children are of infants.

The survey also discovered that mothers of ages below 20 years have low income on the average (below Tshs. 2,000), and in many cases, were dependants to their families. With low level of socio-economic development which was observed in the survey area, together with the low age at birth of their children, it is true that the maternal factors which are associated with infant deaths such as immature reproductive organs, lack of experience and ignorance in hospital services, particularly during delivery, intensify the risk of deaths to the children.

Age boundaries between 20-35 years show significantly low level of infant mortality, that is, 9.3% and 5.4% (for 20-27 and 28-35 years respectively as compared to 17.9% of ages below 20 years. Also, it was found that age group between 20-35 years have high fertility per woman (that is, 2.5 and 3.8 for ages 20-27 and 28-35 years respectively). On the other hand, mothers of ages less than 20 years showed 0.9 fertility rate, value which would be expected to have very low infant mortality rate. Therefore, low infant mortality rate to the age group 20-35 years indicates that problems which probably were the main cause of children deaths in the lower ages of mothers have diminished and the respondents have gained experience in childbearing.

On the other hand, ages of mothers above 35 years were observed to have high infant mortality. Although memory lapse in this age group tended to distort the quality of the data, the method used in analyzing mortality to children revealed high risk of deaths at their early stage of life (See Table 3.3.1).

In conclusion, the findings which regard age of mother and infant mortality tallies with the documented findings which were outlined in chapter one.

4.2.2. The Measurement of Infant Mortality by Parity

Infant mortality, when measured by parity of the dead children (see Table 3.3.1) shows that first born children and children of higher birth orders, that is, orders five and above, is high. On the other hand, parities 2-4 have low infant mortality on the average.

It is customarily observed that in Tanzania, many deliveries take place at home particularly in the rural area. For instance, respondents in the rural area (e.g. the Ilembo ward) reported that there were a few Traditional Birth Attendants (TBA's) who, in their absence, their role was taken over by old mothers who were thought of being

experienced in child bearing. However, in both cases, delivery was successful only where there were no major problems like operations and serious medical attention. In many cases, there was loss of the child and sometimes the mother.

- first parity
- low age
- poor socio-economic factors

It was seen in the Literature Review that first parities are associated with many factors which can lead to the death of the children (and sometimes the mothers). These include lack of experience in childbearing and some biological and physiological complications to some mothers. When these problems are combined with low age at childbearing and poor socio-economic factors, may lead into infant mortality.

Deaths to children of orders 2-4 are fewer (that is 97 out of 309 infant deaths) as compared to those in the first parity (100 out of 309), but still high on the average. On the other hand, deaths to children born in the higher birth orders are the highest, that is, 112 out of 309 infant deaths. In this case, exhaustion of the mothers' ability in childbearing, depletion in family resources and development of physiological weaknesses in the mothers' reproductive organs, when intensified by poor socio-economic factors are responsible for high infant mortality to higher parities.

4.2.3. The Measurement of Infant Mortality by Birth Interval

The high fertility which characterises the norms and values of many Tanzanian traditions causes short intervals between births. Birth intervals of at most 24 months between two successive births was reported as common, particularly in the rural area (see Table 3.3.3). Consequently, children who were reported dead during infancy were the victims of this short birth intervals. Table 3.3.3 shows that, of the 293 infant deaths which were measured by birth interval, 249 were of birth intervals ranging from 18 to 35 months. However, a birth interval of 24 months was reported as common by many respondents. Children born after a normal birth interval, that is, a birth interval ranging between 24-36 months, have less infant mortality. This group shows the least proportion dead during infancy, that is 0.069 out of 360 children deaths. It was further observed that there was more infant mortality for children born after a period longer than normal length of birth interval, that is, more than 48 months. In this category, of the 27 children deaths, 0.2105 is the proportion dead during infancy.

It may be concluded that short birth intervals do not allow the mothers to recuperate fully from the damages of

the previous births. Also, short birth intervals result into having many children within a short period. Therefore, with low level of socio-economic development, it becomes difficult to care for the children and thus increases risk of death. On the other hand, birth intervals longer than normal, have biological and/or physiological problems which may result into children deaths.

4.2.4 The Measurement of Infant Mortality by Socio-Economic Factors

The urban residence, with relatively developed socio-economic facilities have lower infant mortality. When Trussell's model was used in the estimation of infant mortality in Mbeya rural and urban areas, it was found that the rural area had 121.8% infant mortality rate as compared to 112.3% of the urban area. This means that for every 1,000 livebirths in the rural area, 121.8 die during infancy. On the other hand, 112.3 of every 1,000 livebirths in the urban area die at infancy stage.

The difference in the two values confirms that poor socio-economic factors in the rural area intensify the effect of the maternal factors on infant mortality.

4.3 Recommendations

The following policy implications emerge from the findings of this study.

(a) The results bring out the importance of ages of childbearing. A rise in the age of childbearing that is, above 20 years, and avoidance of ages above 35 years should be encouraged by every means in the Tanzanian society. This may be the strongest method which can reduce infant mortality in Tanzania. However, this may not be an easy task as it is likely to be accompanied by major changes in norms and values leading to a reduction of fertility in those ages. Consequently, reduction in infant mortality will be realized.

Since childbearing at these ages is still deeply rooted in many tribes of Tanzania, implementation of this policy may encounter a lot of difficulties. However, increase and enhancement in women education may have a positive effect on ages of childbearing. This, will reduce fertility in the ages below 20 years

and therefore, infant mortality. On the other hand, educated women tend to drop off fertility at higher ages (Swalehe, 1988), therefore, infant mortality which are associated to those ages will also drop.

It therefore becomes imperative that younger women, the potential for determining future generation, must be given more education as an alternative to early marriage and early childbearing.

(b) Delivery of first and fifth and above birth orders should take place in hospitals with more specialized personnel in child delivery. This can combat any risk of death which may be both to the child and the mother.

However, implementation of this policy may encounter a number of difficulties. Many deliveries particularly in the rural area take place at home. To discourage this character, home delivery should strictly be condemned. Instead, the Maternal and Child Health Centres (MCH), be intensified as the primary instrument

agents transmitted through water and poor sanitation. This study however, could not find out any statistical significant effect of water supply and sanitation on child mortality. It is therefore, recommended that a study should be done in Kilimanjaro region devoted solely on the impact of water and sanitation on infant child mortality.

This study did not explore the mechanism through which the proximate determinants (maternal age, parity and birth interval) operate to influence infant and child mortality. A study which includes illness, injury and nutritional status of a child may add a useful knowledge.

5.5. LIMITATION OF THE STUDY

Most socio-economic variables share the reference time problem. The variables are measured at the time of the survey whereas the mortality being analyzed has occurred earlier. However, as Preston (1985) states it is not as serious a setback as is commonly believed; from the fact that social mobility in developing countries is not generally rapid. Therefore, the present functions as a good indicator of the past.

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

Appendix 3(b): COEFFICIENTS FOR ESTIMATION OF CHILD MORTALITY MULTIPLIERS, TRUSSELL VARIANT, WHEN DATA ARE CLASSIFIED BY AGE OF MOTHER

Mortality model (1)	Age group (2)	Index i (3)	Mortality ratio[a] q(x)/D(i) (4)	Coefficients a(i) (5)	b(i) (6)	c(i) (7)
North	15-19	1	$q(1)/D(1)$	1.1119	−2.9287	0.8507
	20-24	2	$q(2)/D(2)$	1.2390	−0.6865	−0.2745
	25-29	3	$q(3)/D(3)$	1.1884	0.0421	−0.5156
	30-34	4	$q(5)/D(4)$	1.2046	0.3037	−0.5656
	35-39	5	$q(10)/D(5)$	1.2586	0.4236	−0.5898
	40-44	6	$q(15)/D(6)$	1.2240	0.4222	−0.5456
	45-49	7	$q(20)/D(7)$	1.1772	0.3486	−0.4624
South	15-19	1	$q(1)/D(1)$	1.0819	−3.0005	0.8689
	20-24	2	$q(2)/D(2)$	1.2846	−0.6181	−0.3024
	25-29	3	$q(3)/D(3)$	1.2223	0.0851	−0.4704
	30-34	4	$q(5)/D(4)$	1.1905	0.2631	−0.4487
	35-39	5	$q(10)/D(5)$	1.1911	0.3152	−0.4291
	40-44	6	$q(15)/D(6)$	1.1564	0.3017	−0.3958
	45-49	7	$q(20)/D(7)$	1.1307	0.2596	−0.3538
East	15-19	1	$q(1)/D(1)$	1.1461	−2.2536	0.6259
	20-24	2	$q(2)/D(2)$	1.2231	−0.4301	−0.2245
	25-29	3	$q(3)/D(3)$	1.1593	0.0581	−0.3479
	30-34	4	$q(5)/D(4)$	1.1404	0.1991	−0.3487
	35-39	5	$q(10)/D(5)$	1.1540	0.2511	−0.3506
	40-44	6	$q(15)/D(6)$	1.1336	0.2556	−0.3428
	45-49	7	$q(20)/D(7)$	1.1201	0.2362	−0.3268
West	15-19	1	$q(1)/D(1)$	1.1415	−2.7070	0.7663
	20-24	2	$q(2)/D(2)$	1.2563	−0.5381	−0.2637
	25-29	3	$q(3)/D(3)$	1.1851	0.0633	−0.4177
	30-34	4	$q(5)/D(4)$	1.1720	0.2341	−0.4272
	35-39	5	$q(10)/D(5)$	1.1865	0.3080	−0.4452
	40-44	6	$q(15)/D(6)$	1.1746	0.3314	−0.4537
	45-49	7	$q(20)/D(7)$	1.1639	0.3190	−0.4435

Estimation equations:

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

$$q(x) = k(i)\,D(i)$$

[a] Ratio of probability of dying to proportion of children dead. This ratio is set equal to the multiplier $k(i)$.

Source: U.N. Manual X(1983)

APPENDIX 4(a): ESTIMATIONS OF INFANT AND CHILDHOOD MORTALITY LEVELS

BY TRUSSELL'S METHOD - MBEYA RURAL AND URBAN DISTRICTS

Five-Year Age Groups of Respondents	Number of Respondents in child-bearing Ages	Number of children Everborn (CEB)	Number of children Dead (D1)	Average Number of children Everborn (P_1)	Number of children surviving	Proportion of Children Surviving	Proportion of Children Dead	Age Interval of the children	Multiplying Factors where $P_{1/P2}$ = 0.382 $P_{2/P3}$ = 0.883	Estimated Proportion Dead q(x)	Probability of Surviving at Exact Age x P (x)	North Model Mortality Level
		C E B	D1	P_1	SI	Ps	D_1		KI	qx=KIDI	1-qx	
1	2	3	4	5	6	7	8	9	10	11	12	13
15-19	205	184	67	0.8976	117	0.6359	0.3641	1	0.7449	0.2712	0.7288	3.7
20-24	208	489	111	2.3510	378	0.7730	0.2250	2	0.7349	0.1654	0.8346	11.9
25-29	249	663	154	2.6626	509	0.7677	0.2329	3	0.7492	0.1745	0.8255	12.6
30-34	148	663	150	4.4792	513	0.7738	0.2262	5	0.8212	0.1857	0.8143	13.3
35-39	161	837	185	5.1988	652	0.7790	0.2210	10	0.8995	0.1988	0.8012	13.9
40-44	82	471	117	5.7439	354	0.7516	0.2484	15	0.9034	0.2244	0.7756	13.5
45-49	79	479	145	6.0631	334	0.6973	0.3027	20	0.9020	0.2730	0.7270	12.4

APPENDIX 4(b): ESTIMATIONS OF INFANT AND CHILDHOOD MORTALITY LEVELS

BY TRUSSELL'S METHOD - MBEYA URBAN DISTRICT

Five-Year Age Groups of Respon-dents	Number of Respon-dents in child-bearing Ages	Number of children Everborn (CEB)	Number of chi-ldren Dead (DI)	Average Number of chil-dren Everborn (P_1)	Number of chil-dren survi-ving	Proportion of Children		Age Interval of the children	Multiplying Factors where P_1/P_2 = 0.354 P_2/P_3= 0.964	Estimated Proportion Dead q(x)	Probability of Surviving at Exact Age x P (x)	North Model Morta-Lity Level
						Survi-ving	Dead					
		C E B	DI	P_1	SI	Ps	D_1		KI	qx=KIDI	1-qx	
1	2	3	4	5	6	7	8	9	10	11	12	13
15-19	80	66	21	0.825	45	0.6818	0.3182	1	0.8950	0.2848	0.7152	3.2
20-24	96	224	49	2.330	175	0.7813	0.2187	2	0.7310	0.1599	0.8401	12.3
25-29	103	249	56	2.417	193	0.7751	0.2249	3	0.7064	0.1589	0.8411	13.4
30-34	58	241	52	4.155	189	0.7842	0.2158	5	0.7676	0.1656	0.8344	14.3
35-39	56	239	54	4.268	185	0.7741	0.2259	10	0.8400	0.1898	0.8102	14.4
40-44	32	177	44	5.531	133	0.7510	0.2490	15	0.8470	0.2110	0.7890	14.1
45-49	29	165	42	5.690	123	0.7450	0.2550	20	0.8546	0.2180	0.7820	14.4

APPENDIX 4(C): ESTIMATIONS OF INFANT AND CHILDHOOD MORTALITY LEVELS

BY TRUSSELL'S METHOD - MBEYA RURAL DISTRICT

Five-Year Age Groups of Respondents	Number of Respondents in childbearing Ages	Number of children Everborn (CEB)	Number of children Dead (D1)	Average Number of children Everborn (P_1)	Number of children surviving	Proportion of Children		Age Interval of the children	Multiplying Factors where $P_{1/P2}$ = 0.399 $P_{2/P3}$ = 0.834	Estimated Proportion Dead q(x)	Probability of Surviving at Exact Age x P (x)	North Model Mortality Level
						Surviving	Dead					
	C E B	D1	P_1	SI	Ps	D_1		KI	qx=KIDI	1-qx		
1	2	3	4	5	6	7	8	9	10	11	12	13
15-19	125	118	46	0.9440	72	0.6102	0.3898	1	0.6528	0.2545	0.7455	4.5
20-24	112	265	62	2.3661	203	0.7660	0.2340	2	0.7362	0.1718	0.8282	11.5
25-29	146	414	98	2.8356	316	0.7633	0.2367	3	0.7835	0.1855	0.8145	12.0
30-34	90	422	98	4.6889	324	0.7678	0.2322	5	0.8541	0.1727	0.8273	13.9
35-39	105	598	131	5.6950	467	0.7809	0.2191	10	0.9357	0.2050	0.7950	13.7
40-44	50	294	73	5.8800	221	0.7520	0.2480	15	0.9375	0.2325	0.7675	13.2
45-49	50	314	103	6.2800	211	0.6720	0.3280	20	0.9307	0.3053	0.6947	11.2