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The Effects of Breastfeeding and Its Co-Variates on Infant and Child Mortality: Some Evidence from Dodoma Region, Tanzania

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Abstract

Mortality control in most developing countries is still at low levels because of high infant and child mortality rates. The infant and child mortality rates for Tanzania are still high despite the observed declining trend in developing countries in the twentieth century. The efficacy of mass campaigns against general or specific diseases and extension of health services is not convincing; hence the importance of emphasising the natural behaviours and means such as breastfeeding that confers protection to infants and children from health scourges.

This paper is a result of a study carried out in some selected localities in Dodoma Region, Tanzania. The major findings were that on average, most women in the study area breastfed for two years. Some socio-economic and biological variables such as education, residence, maternal age, parity, and birth interval were found to be strongly correlated with both breastfeeding and under-five mortality. However, the variables have a strong effect on mortality of the under-fives than breastfeeding. Furthermore, it was found that breastfeeding for long duration is beneficial to young children, especially infants. Nevertheless, its positive effects are elevated in a multivariate perspective. Factors that increase mortality risks not only increase the importance of breastfeeding for children's survival, but also increase the age up to which its benefits continue to be important. In retrospect, this suggests that any policy intervention designed to promote breastfeeding should concern itself primarily with how children of the most deprived subgroups are fed, and should stress continuation of breastfeeding to higher ages for those same subgroups.

Introduction

Mortality is a very important component in the study of population dynamics. Not only is it an indispensable part of the famous balancing equation of population change, but it is an inescapable dimension of human experience, hence an inevitable eventuality to every mortal. Although the control of mortality has been one of man's greatest achievements so far, contemporary debates about the current crisis in health care reveal that many studies share two but controversial assumptions regarding health and illness.

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One school of thought asserts that the determinants of health and illness are predominantly biological; hence the patterns of morbidity and mortality have little to do with the social and economic milieu in which they occur (see, for example, Doyal, 1979). Consequently, the solution to the prevailing health problems seems to lie within the context of modern medicine, belittling the social changes in any society as having no effect at all. Alternatively, another school maintain that it is the mode of social and economic organisation in a society which govern the health dynamics, and hence mortality (Hansluwka, 1975; Bawah & Zuberi, 2005).

The controversy becomes more pronounced when addressing the issue of mortality decline in developing countries like Tanzania. Whereas some researchers have attributed mortality decline to the introduction of medical technology (see, for example, Stolnitz, 1965; Arriaga & Davis, 1969), others view the improvement in the social and economic aspects as a major factor contributing to mortality decline in developing countries (UN, 1980; Gwatkin, 1980; Sivamurthy, 1981; WHO, 2001).

It is perhaps the above controversy that prompted Mosley and Chen (1984) to develop a conceptual framework for the study of mortality that embraces both biological and socio-economic correlates. The framework was to smoother the apparent biases between social scientists and medically inclined researchers as regards the determinants of mortality (see Betran et al., 2001). This paper is based on a study conducted in Tanzania to establish if both breastfeeding and mortality are likely to be influenced by common socio-economic and biological factors. The data were collected from selected areas in Dodoma Region in Tanzania.

Setting the Scene

Infant and child mortality is an important component of overall mortality, and it is thus a sensitive indicator of advance in mortality control either through endogenous economic development or through exogenous medical advance. Differences in mortality patterns abound among the developed and developing worlds. In the former, there is a sharp drop in death rate from the first year, whereas in the latter higher death rates persist throughout early childhood (UNFPA, 1983).

Mortality control in most developing countries is still at low levels because high infant and child mortality rates still prevail. In general, the rate of mortality decline had been slower in the late 1960s and in the mid 1970s (Gwatkin, 1980, Amouzou & Hill, 2004), whilst in some other countries the decline has come to a standstill or even reversed altogether (Arriaga, 1981; Sivamurthy, 1981; UN, 1982). Mortality for the combined four years of early childhood has been found to exceed 50% of the infant mortality rate, sometimes equalling the rate in the first year, or exceeding it. This is characteristically different from what happens in developed countries where child mortality rates are usually under 20% of infant mortality rates (Sembajwe, 1980; Amouzou & Hill, 2004).

Tanzania, like most developing countries, has high infant and child mortality rates (Tanzania/UNICEF, 1985; Bawah & Zuberi, 2005) despite the observed trend of

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slow mortality decline in developing countries in the twentieth century. The rates for the censual years 1957, 1967, 1978 and 1988 were 190, 160, 137 and 115 per 1,000 live births respectively; whereas according to the latest census of 2002, the infant mortality rate was 95 per thousand live births, and child mortality rate was 66 per thousand live births (National Bureau of Statistics, 2006). Despite that, the trend of infant and child mortality shows a decline, the level is however still high as the rate of decline is very low. It is due to this alarming situation that a thorough analysis of mortality trends becomes a necessity so as to come up with informed policy issues to redress the situation.

For developing countries like Tanzania, whose economies are still agrarian and most people are still rural, mass campaigns against general or specific diseases and the efficacy of extension health services is not very convincing. As such, it is imperative at this level of development to emphasise those natural behaviours and means that confer protection to infants and children from health scourges. Breastfeeding is one of such natural behaviours. It is well known that breastfeeding has a significant impact on reducing mortality in infants and early childhood (Huffman, 1984; Victoria et al., 1999; Arifeen et al., 2001) through its ability to provide a well balanced diet to an infant and a young child, especially for those who cannot afford formula food; and also provides protective effect against diseases in children. Studies conducted in developed countries (see for example, Jain et al., 1970; Ginneken, 1977; Page et al., 1982; Da Vanzo et al., 1986; Rosenberg, 1989; among others) and in developing world (Singarimbum et al., 1976; Perez et al., 1978; Ferry et al., 1983; Ahamed, 1986; Ahmed et al., 1991; Majumder, 1991, Akwara, 1994; Arifeen et al., 2001)[1] concur with the above statement. This study was carried out in Tanzania to establish the relationship of breastfeeding and mortality; and how the two are influenced by socio-economic and biological factors.

The Analytical Framework

A framework for the analysis of infant and child mortality should include various factors in the determination of the level of mortality. These factors are demographic, economic and political, environmental, medical and health care, cultural and geographic (Meegama, 1980). In this study we adopt a model which includes variables that can be measured in less developed countries. The framework consists of three levels and these are; infant and child mortality, breastfeeding, socio-economic and maternal factors.

Description and justification for the levels and the variables

Infant and child mortality: This is the mortality of the under-fives, that is, deaths of children before celebrating their fifth birthday.

Breastfeeding: Breastfeeding has been cited to be important nutrition-wise to children especially in early years of life.

[1] According to Ariffen et al, (2001), infants who were partially breastfed or not breastfed had a risk of diarrheal death 3.94 times greater (95%) than exclusively breastfed infants.

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Socio-economic and maternal factors

(1) *Income:* Income influence the provision of things such as food, hygienic and preventive care which are essential for the survival of the under-fives.

(2) *Occupation:* Mother's occupation affects the health of the child through lack of proper feeding and insufficient breast-feeding due to its effect on mother's time.

(3) *Residence:* Mother's place of residence is used as a proxy for living conditions. For instance, urban residents are presumed to have better living conditions and have more access to medical and health facilities than the rural counterparts.

(4) *Education:* Maternal education influences health care practices related to contraception, nutrition, hygiene, and preventive care.

(5) *Parity:* High parity women are expected to experience more deaths for their under-fives than otherwise. This is because, these women usually have shorter birth intervals, breastfeed for shorter duration, and hence the children benefit less from the breast milk.

(6) *Birth interval:* Short interval between births weaken the mother physically and psychologically, hence becoming unable to give adequate care to the child during infancy as the amount of care and attention of the mother to both the new born and the young child will be greatly reduced.

(7) *Age:* At the extremes of maternal age groups and birth orders, the risk of infant and child mortality is usually highest.

The Variables

The variables used for analysis are presented in Table 1 together with their description and categories.

Table 1: Variables and Measurement in the Analysis

Variable	No	Abbreviation	Measurement
Mortality	1	MOR	Proportion of children dead: (a) Under 1 year (b) 1 to under 5 years
Breastfeeding	2	DBF	Number of months breastfed in the last closed birth interval (LCBI)
Level of education of mother	3	EDU	Years completed formal schooling*
Occupation of mother	4	OCC	Ranking of occupations based on status and skill: 1= Agricultural work 2= Others ** 3= Office work
Maternal age	5	MBP	Age of mother at birth of penultimate child in years (15-49).

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Current age of mother	6	AGE	Completed single years
Parity	7	CEB	Number of children ever born alive
Place of residence	8	RES	Dichotomised 1= rural 2= urban
Income/Year (in Tsh)	9	INC	Amount in Tanzanian shilling nine categories ***
Birth interval	10	BI	The number of months the women spent in the LCBI

Note: * 0 = no education; 1 = adult education; 2 = primary 1-4; 3 = primary 5-7; 4 = secondary and above
** Others include unskilled manual, skilled manual and business.
***1= Less than Tsh. 10,000; 2 = Tsh. 10,000–30,000; 3= Tsh. 30,001–50,000; 4= Tsh. 50,001–70,000 5= Tsh. 70,001–100,000; 6= Tsh. 100,001–150,000; 7= Tsh. 150,001–200,000; 8= Tsh. 200,001–240,000; 9= Tsh. 240,001 and above

The Study Area and Research Design

Dodoma Region, centrally located in Tanzania, is one of the twenty regions of mainland Tanzania and also the official capital, although almost all government administrative activities are still conducted from the former capital, Dar es Salaam. The region has a population of 1,288,088 (URT, 2002), and four administrative districts, namely: Dodoma Urban, Dodoma Rural, Kondoa, and Mpwapwa. Ecologically the region is very fragile. Its low rainfall results into poor vegetative cover, and because of overgrazing and cultivation of the marginal lands, deforestation and soil erosion is rampant in the region. The inhabitants of the region comprises of four different ethnic groups, namely, the Gogo (which is the largest ethnic group), Rangi, Hehe, and Kaguru.

The infant mortality rate (IMR) and the child mortality rate (CMR) for Dodoma are still high. According to the latest census (2002) figures, the IMR and CMR for the region are 114 and 87 per thousand live births, respectively (National Bureau of Statistics, 2006). In general, the IMR and CMR were found to be high in rural Dodoma than in urban areas.

The field survey covered 1000 households, half in Dodoma Urban district and another half in Dodoma rural. For Dodoma Urban, all divisions within the radius of 40km from the town were listed. A random sampling was done, and one division called Mjini division was chosen. This division depicted the typical urban characteristics. From this division three wards—namely, Uhuru, Makole and Kilimani—were randomly chosen. For Dodoma rural, Chilonwa division was a randomly selected, from which Buigiri and Chilonwa wards were also randomly selected. Field data were collected mainly through a questionnaire.

The collected data were evaluated for internal inconsistencies. Problems of age heaping and age preference were minimised by grouping ages. It was also ascertained that memory error in reporting child-ever-born was minimised by the construction of subsidiary questions in the questionnaire which sort of counterchecked the prior

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questions of the number of children reported. Age misreporting among women was very low because of the compensatory effects arising from the women reporting their ages randomly. Zero error could not occur in this study because women with no parity were classified as a 'not stated category' of women. The data were analysed using an SPSSPC+ statistical package.

The Analysis and Discussion of the Findings

The data were analysed at three levels. We present the univariate analysis in a tabular form to show the effect of each variable on the infant and child mortality. For those variables whose relationships are not explained by the univariate analysis, a correlation matrix is applied. We further determine the strength of the effects between the variables by using the multiple regression analysis.

Generally, breastfeeding is a common phenomenon in the society studied. The mean duration of breastfeeding in the last closed birth interval is estimated to be 21 months, and it is further revealed that 83% of the total women studied breastfeed their children for a year and above. The mean duration of breastfeeding is, however, affected by maternal characteristics. It was observed that mothers of young maternal ages, those having short birth intervals and low parities breastfeed for shorter duration and vice versa. Mothers under the age of 35 breastfeed for somewhat shorter period than those of age 35 and above. This has been found to be true for other areas as well (Rabei, 1984; Yoon et al., 1996). For young mothers with low parities and shorter birth interval, the argument is that breastfeeding is cut short by next conception in a bid to reach an anticipated family size.[2] On the other hand, young mothers are more likely than their older counterparts to be more educated and to be working away from home, thus have limited time for a prolonged breastfeeding (see also, Jain et al., 1970; Chen et al., 1974; Amankwaa, 2003).

On the socio-economic characteristics, education and income have been found to have a negative association with duration of breastfeeding. There is a systematic decline of duration of breastfeeding as the education and income level of the mother increase. Highly educated mothers are usually employed in the modern sector, and therefore more likely to work away from home; and this may compete with child bearing, and hence shorter duration of breastfeeding. Educated women can also afford to supplement breast milk with an equally nutritive formula food. Maternal employment has been cited to be one of the main causes for the decline of breastfeeding in many parts of the world. Even if maternal employment does not play a significant role in the overall decline of breastfeeding, employment constraints both the opportunity to breastfeed for many mothers, and also their ability to engage in other child activities (Ahamed, 1986; Akwara, 1994).

Furthermore, mothers working in modern sector tend to be modern in their outlook, hence abstain from cultural norms and customs which more than often encourage

[2] Yoon et al., 1996 asserts that there is a strong relationship between breastfeeding and previous birth interval: children who were born 18 months or less after a sibling were much less likely to be breastfed.

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prolonged breastfeeding both for the health of the child and contraceptive purposes. Urbanisation is associated with lower prevalence of breastfeeding because of the lifestyles in modern towns and cities that are somehow incompatible with the practice. Also, the urban women population are of young ages, have less parities, are mostly better educated, and have relatively higher incomes—factors are known to have a negative influence on breastfeeding. Table 2 present the mean duration of breastfeeding by maternal characteristics.

Table 2: Mean duration of breastfeeding (in months) by maternal characteristics

Parity:	1 - 2	20.09 (149)
	3 - 4	19.49 (230)
	5+	22.87 (272)
Mother's Education:		
	No education	24.58 (167)
	Primary 1 - 4	23.45 (60)
	Primary 5 - 7	19.83 (320)
	Secondary and above	17.12(82)
Place of Residence:		
	Rural	23.34 (303)
	Urban	19.05 (348)
Type of Occupation:		
	Agricultural work	23.07 (309)
	Others	18.56 (139)
	Office work	19.59 (202)
Family Income/Year (Tsh):		
	10,000 - 29,999	22.87 (287)
	30,000 - 69,999	20.59 (195)
	70,000 - 149,999	18.54 (123)
	150,000+	17.50
Maternal Age:		
	<18 yrs	19.8(74)
	18 - 30 yrs	20.6 (422)
	>30 yrs	22.8 (146)
Birth Interval in LCBI:		
	<1 yrs	10.3 (3)
	1 - 2 yrs	15.7 (98)
	2+ yrs	22.1 (541)

Source: Dodoma Survey (2004)

Note: The grand total for different characteristics is not the same because of the missing cases. The number of cases is given in parentheses.

Differentials in Infant and Child Mortality

High risks of mortality and death for children born to mothers in both extreme maternal ages have been reported (Hobcraft et al., 1984). The roles of biological and environmental factors leading to this phenomenon have been advanced. It is suggested that immature maternal reproductive tissues development could adversely affect the outcome of pregnancy to very young mothers (Ahmad et al., 1991; Shahidullah, 1994). In young mothers, it is further argued, pregnancy taxes their

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bodies, increasing nutrient demand which may not necessarily be met, and consequently leading to birth of babies with low weight who are prone to risks of death. Inexperience in child caring skills, which may be caused by poor economic capability and mental or psychological immaturity, cannot be ignored when considering factors leading to high risks of death in children of young mothers.

On the other hand, maternal depletion syndrome and weakness of maternal reproductive tissues may contribute to higher risks of death for children of older mothers. Older mothers have high incidence of birth complications leading to death of their children. Chromosomal aberrations and other abnormalities have been found to be more prevalent in older mothers leading to defective embryos, which result into weak infants who may die sooner in their childhood.

From the above explanation, we would expect a 'U' shaped relationship between infant and child deaths and maternal age. In this study, we also found that young mothers and older mothers (considering both current age and maternal age at birth of their penultimate child) have high proportions of children dead (Table 3). This observation conform to the explained 'U' shaped curve, and further gives legitimacy to other studies done in Liberia (Ahmad et al., 1991) and in Rural North East Brazilian Community (Bailey et al., 1990).

Table 3: Proportion Children Dead Under-five Years by Subgroups of Women

Age:	
15 - 24	0.192 (70)
25 - 39	0.168 (322)
40 - 49	0.225 (118)
Parity:	
1 - 2	0.144 (90)
3 - 4	0.164 (175)
5+	0.214 (245)
Education: No education	0.270 (165)
Primary 1-4	0.187 (50)
Primary 5-7	0.138 (250)
Secondary +	0.123 (45)
Place of residence:	
Rural	0.248 (284)
Urban	0.104 (226)
Occupation: Agriculture work	0.576 (249)
Others	0.094 (79)
Office work	0.103 (132)
Family Income/year (Tshs):	
10,000 - 29,999	0.611 (227)
30,000 - 69,999	0.131 (135)
70,000 - 149,999	0.090 (81)
150,000+	0.063 (18)

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Breastfeeding duration (yrs):	
<1	0.164 (48)
1 - 2	0.151 (304)
2+	0.220 (126)
Maternal age:	
<18	0.224 (57)
18 - 30	0.148 (290)
30+	0.178 (121)
Birth Interval in LCBI (yrs):	
<1	0.347 (2)
1 - 2	0.153 (70)
2+	0.167 (396)

Source: Dodoma Survey (2004) (N=510)

Note: The grand total for different characteristics is not the same because of the missing cases. The number of cases is given in parentheses.

From Table 3, we observe that the higher the parity of the mother, the higher the proportion of children dead. We can observe 70 more deaths per 1000 live births in those women of parity 5 and above, as compared to women of parity 1 and 2. The proportion of infant and child deaths by parity is described by J-shaped curve, lowest at parity 1 and 2, and highest at parity 5 and above. These results have also been obtained in Brazil (Bailey et al., 1990) and in Bangladesh (Shahidullah, 1994).

Children of birth order five to nine, and first born children suffer a death rate of about 16% higher than those of birth orders two to four (see Mott 1982 cited in Ewbank et al., 1986). Reasons believed to cause the observed association between infant and young children deaths with birth order have been elucidated. First born children are more likely to be born to young mothers who are psychologically, socially, economically and biologically less prepared to bear and bring up a child (WFS, 1983). Thus, higher risks of death of first born children are associated with underdeveloped pelvic size of the mother and birth weight of the baby leading to complicated births. Also, it has been substantiated in other studies that the first pregnancy may be defective due to less blood supply to the placenta (Tanzania/UNICEF, 1985).

As for the case of developing countries, young mothers are less capable both mentally and economically to fend for themselves. The cost of bringing up a child may be unbearable to a young mother, leading to poor nutrition of herself and the child. High birth order children are more likely to be born to mothers whose reproductive capacity have diminished as a result of depletion and weakness of maternal reproductive tissue. This may lead to giving birth to underweight infants who might grow into feeble children prone to infections. Furthermore, high birth order children have to compete with older siblings in terms of family resources, food, mother's love, etc.

There is a systematic decrease of mortality to the under-fives as the level of maternal education and income increase (see Table 3): The mother is the immediate agent through whom social institutions must act to safeguard the health and life of the child

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in the home, and her attitudes and abilities are of great importance. Educated mothers are not only more likely to seek medical attention for their children, but also tend to enjoy favourable responses from medical services, changes in the maternal concept of child care in the traditional balance of familial relationships and in relations with public institutions. Literate mothers have control over their own health, reproductive behaviour, and can regulate to a required degree those responsibilities that can limit their responses to care for their children. On the other hand, high income enables mothers to afford good nutrition both for themselves and their children, health services (both preventive and curative), and live in better environment, factors which are determinants of good health. Those in low income bracket cannot afford the same, hence the exposure of their children to many agents of infection and consequently high mortality.

As regards the duration of breastfeeding, this study reveal that there is high mortality for children who breastfeed for less than one year and those breastfeeding for more than two years, compared to those breastfeeding for one to two years. In a developing country context, we can attribute this observation to the fact that children who breastfeed for less than a year do get the necessary protective and nutritive benefits conferred by breast milk, hence succumb easily to infections which leads to early deaths. For those breastfeeding for more than two years, it is thought that although the nutritive effect of breast milk is still beneficial, its protective effect diminish, hence other exogenous factors become even more important in determining the survival of the child.

Birth interval was found to have an impact on infant and child mortality. In this study we found that women whose birth intervals between their last two births were less than a year had more mortality episodes of their offspring.[3] It is suggested that short birth intervals do not allow mothers to fully recover from the throes of the more recent pregnancy (Palloni & Millman, 1986; Shahidullah, 1994). Furthermore, an immediate conception will necessitate cutting short breast-feeding of the suckling index child, weaning it prematurely, and hence depriving the child of the benefits of breast milk. Moreover, short birth intervals interfere with child caring in the sense that a mother with two young siblings will not be able to devote her full attention to either. In most cases the just weaned sibling will be left in the hands of other people such as the older siblings who may not be able to offer the right child care.

The Correlation Analysis

We have endeavoured to establish the relationship between the variables by looking at the pattern in a tabular analysis. We advance further our analysis to establish the degree of this relationship by utilising the simple correlation approach (Table 4). We note that variables education and income are negatively correlated with infant and child mortality. This correlation is significant at 0.01 level. The implication of this

[3] Short subsequent birth interval had the greatest impact on infant and child mortality. If the mother became pregnant again, the index child was 4.4 times more likely to die than a child whose mother did not become pregnant again.

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correlation is that the higher the level of education and income, the lower the infant and child mortality. Likewise, the two variables are negatively correlated with duration of breastfeeding, and the coefficient is significant at 0.01 level. This suggests that at higher levels of education and income, mothers tend to breastfeed for shorter duration and vice versa. The occupation of the mother is found to have weak negative correlation coefficients with both infant and child mortality, and duration of breastfeeding. However, from the direction of the coefficients, it is clear that the higher the status of the occupation of the mother, the lower the mortality of the under-fives, and the shorter the duration of breastfeeding.

Table 4: The correlation matrix

	MOR	DBF	MBP	BI	CEB	AGE	RES	EDU	OCC	INC
MOR	1.0000									
DBF	.1321*	1.0000								
MBP	-.0034	.1285*	1.0000							
BI	.0395	.3033**	-.0185	1.0000						
CEB	.1873**	.2429**	.6904**	.1338*	1.0000					
AGE	.1265*	.2042**	.8211**	.2227**	.7155**	1.0000				
RES	.3125**	-.2873**	.0950	-.01000	.2203**	.0681	1.0000			
EDU	-.2890**	-.3005**	-.2464**	-.0895	-.4160**	-.3240	-.4845**	1.0000		
OCC	-.0703	-.1026	-.0990	-.0759	.0719	-.1443*	.2510**	-.3437**	1.0000	
INC	-.2585	-.2462**	.0116	-.0302	-.1471**	-.0136	-.5848**	.4343**	-.2932**	1.0000

Source: Dodoma Survey (2004) (N = 570)

Note: * 1- tailed significance 0.01 ** 1-tailed significance 0.001

There is a strong positive correlation between the variable parity with mortality of infants and young children. The correlation coefficient is significant at 0.001 level, showing that the higher the number of children-ever-born, the higher the number of children dead. Parity is also strongly correlated with duration of breastfeeding. The coefficient is positive and significant at 0.001 level. It is thus deduced that women of low parities breastfeed for short duration and vice versa.

Place of residence is positively correlated with under-five mortality, and significant at 0.001 level. This observation is in favour of rural residents, implying that there is higher mortality risk among children born to rural mothers. On the other hand, residence and duration of breastfeeding are negatively correlated. The coefficient of correlation has a high magnitude, and significant at 0.001 level. The sign of the coefficient favours urban residents, suggesting that urbanites breastfeed their offspring for shorter duration than their rural counterparts.

Age of the mother is found to be positively correlated with both mortality for the under-fives and duration of breastfeeding. The coefficient of correlation between age and under-five mortality is significant at 0.01 level, whereas that of between age and breastfeeding is significant at 0.001 level. At higher ages, mothers tend to experience more deaths of their children, and breastfeed longer. Although duration of breastfeeding has a statistically significant correlation with under-five mortality, the coefficient is of

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less magnitude and has an unexpected sign. This observation could be attributed to the fact that since the variable—mortality—included infants and young children, and as such the effects of breastfeeding on mortality are masked by the presence of older children, suggesting that the effects of breastfeeding are more prominent in very young ages. As expected, birth interval is positively correlated with breastfeeding, the coefficient being of high magnitude and significant at 0.001 level. The inference here is that the shorter the birth interval, the shorter the duration of breastfeeding.

Conclusively, it can be observed that whereas the variables 'residence', 'education', 'age', 'parity' and 'birth interval' have strong positive relationship with 'duration of breastfeeding', statistically significant at 0.001 level; maternal age is correlated positively with breastfeeding, but significant at 0.001 level. On the other hand, the variables 'occupation', 'birth interval', and 'maternal age' have weaker linear relationship with the under-five mortality.

Regression Analysis

When regression analysis was carried out using the Ordinary Least Square (OLS) technique, out of the eight explanatory variables included in the regression equation, only 'education', 'place of residence' and 'birth interval' are found to have a statistically significant effect on duration of breastfeeding. The 'maternal age', 'occupation', 'parity', and 'age' variables have weak effect on duration of breastfeeding. R^2 for all eight variables is 21.3% (Table 5).

Table 5: *Standardised regression coefficients* for the determinants of breastfeeding - entire method

Independent variable	Coefficients
Birth interval	0.2777**
Residence	-0.1614**
Maternal age	0.0147
Occupation	**-0.0156**
Education	-0.1121*
Income	-0.0752
Parity	0.0836
Current age	0.0220
R^2	21.3%

Source: Dodoma Survey (2004)

Note: **significant at 0.01 level
*significant at 0.05 level
R^2 = 21.3%

The 'duration of breastfeeding' variable was added to the eight variables mentioned in Table 5 to see its effects on infant and child mortality. Multiple regressions for both infant mortality and child mortality were carried out. Five models were formed by dropping one variable among those with high correlation ($r \geq 0.5$). The five different models were compared to demonstrate shifts in estimated effects of certain variables when a particular variable is controlled.

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Table 6 gives the standardised regression coefficients for the determinants of infant mortality. The 'duration of breastfeeding' variable is found to have a weak effect on infant and child mortality. However, the effect of breastfeeding is in the expected direction, which was not the case in correlation analysis. When 'residence' variable is controlled, the explanatory power of the explanatory variables in the equation is reduced from 8.8% to 6.8% (Model 2), while the magnitude of the coefficients of variables 'education', 'income' and 'parity' increase, though not significantly.

Table 6: Standardised regression coefficients for the determinants of infant mortality

Independent Variable	Coefficients				
	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Birth interval	-0.0519	-0.0564	0.0181	-0.0488	-0.0017
Residence	-0.2037**	-	-0.1873**	-0.2051**	-0.1955
Maternal age	-0.3469**	-0.3291**	-	-0.3176**	0.1705**
Occupation	0.0984	0.0193	0.1071	0.0902	0.1305*
Breastfeeding	-0.0502	-0.0304	-0.0520	-0.0465	-0.0485
Education	-0.0884	-0.1134	-0.1146	-0.0997	-0.1228
Income	-0.0387	-0.1021	-0.0583	-0.0406	-0.0401
Parity	0.0869	0.0906	0.0118	-	0.1456
R^2	8.8%	6.8%	5.7%	8.5%	7.1%

Source: Dodoma survey (2004)

Note: ** significant at 0.01 level
* significant at 0.05 level

Model 3, which is formed by controlling maternal age, offers some interesting results. The coefficient of determination (R^2) is reduced from 8.8% to 5.7%, and only variable 'residence' is significant at 0.01 level. Whereas the dropping of the variable 'parity' in Model 4 does not bring any profound change in the R^2. In Model 5, where the variable 'age' was dropped, R^2 was reduced by 1.1%; with variables 'occupation', 'education' and 'parity' becoming significant at 0.05 level. From the above observations, place of residence, maternal age and current age of the mother are found to have strong effect on infant mortality than breastfeeding.

Table 7 presents the standardised regression coefficients for the determinants of child mortality. In all five models, the variable 'duration of breastfeeding' does not seem to be significant, but the magnitudes of the coefficients are much smaller than was the case in Table 6. This shows that the effects of breastfeeding are much stronger in infants than in children above year one. Education is found to be significant in all models, whereas when age is controlled (Model 5), education and parity -- which were significant at 0.05 level in determining infant mortality -- now become significant at 0.01 level. Maternal age has a strong effect on child mortality as well, because by dropping it in Model 3, the explanatory power of the remaining variables is reduced by 51% -- that is from 18.5 to 13.4%.

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Table 7: Standardised regression coefficients for the determinants of child mortality

Independent variable	Coefficients				
	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Birth Interval	-0.0777	-0.0821	0.0116	-0.0709	-0.0158
Residence	-0.2123**	-	-0.2149**	-0.2382**	-0.2251**
Maternal age	-0.4415**	-0.4178**	-	-0.3825**	-0.2239**
Occupation	-0.0585	-0.0359	0.0667	0.0400	0.0946
Breastfeeding	-0.0021	0.0201	-0.0051	0.0042	-0.0071
Education	-0.1171*	-0.1406*	-0.1448*	-0.1333*	-0.1536**
Income	-0.0689	-0.1427**	-0.0941	-0.0729	-0.0710
Parity	0.1704*	0.1699*	0.0708	-	0.2371**
Current age	0.3231**	0.3158**	0.0094	0.3938**	-
R^2	18.5%	15.7%	13.4%	17.3%	15.9%

Source: Dodoma Survey (2004)

Note: ** significant at 0.01 level
* significant at 0.05 level

We can now conclude that education, parity, residence, maternal age at birth of penultimate child and current age of the mother have very strong effect on child mortality.

Conclusion

We have established in this study that many women (82.8%) in the selected areas of Dodoma in central Tanzania breastfeed for more than a year, the mean duration of breastfeeding being 21 months. However, the study reveals that breastfeeding is not the main determinant of under-five mortality in the studied areas. On the other hand, education, residence, maternal age, parity, and birth interval are the variables found to be strongly correlated with both breastfeeding and under-five mortality. The variables mentioned are found to have a strong effect on mortality of under-fives than breastfeeding. The findings also show that breastfeeding for long duration is beneficial to young children, especially infants. Nevertheless, its positive effects are elevated in a multivariate perspective.

Apparently, factors that increase mortality risks not only increase the importance of breastfeeding for children's survival, but also increase the age up to which its benefits continue to be important. In retrospect, this observation suggests that any policy intervention designed to promote breastfeeding should concern itself primarily with how children of the most deprived subgroups are fed; and should stress continuation of breastfeeding to higher ages for those same subgroups. It is suggested that causal relationships between variables are reinforcing rather than distinct and separable.

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