Original article

Estimation of child mortality in Addis Ababa

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Abstract: Estimation of mortality level in children below the age of five may have profound impact on a number of demographic parameters. Childhood mortality data are also useful in assessing the impact of child survival programs and identifying child populations that are at risk. In March 1993 a survey was conducted to assess the child mortality rate in Addis Ababa. In the study a sample of 548 ever married women were interviewed regarding the number of children ever born, surviving and dead. A variant of the original Brass estimation procedure (Trussell's method) which is based on data classified by duration of marriage is applied. Accordingly, the under-five mortality rate (q_5) is estimated to be 114 per 1000. The results, therefore, suggested that under five mortality rate remains high in Addis Ababa. Integrated maternal and child health intervention programmes have to be strengthened in order to reduce this high level of child mortality rate.[*Ethiop. J. Health Dev.* 199-;0(0):00-00]

Introduction

Estimation of mortality level in children below the age of five many have profound impact on a number of demographic parameters. Childhood mortality data are also useful in assessing the impact of child survival programs and identifying child populations that are at risk. Among the objectives of any Maternal and Child Health/Family Planning program, reduction of sickness and death among mothers and children by promoting the reproductive health of women as well as the physical health and development of children and adolescents are considered to be the main ones (1).

Infant and child mortality rates have been reduced substantially in the developing world in recent decades. The demographic and health survey (DHS) findings indicate an increase during the late 1970s and 1980s in the pace of decline in childhood mortality in Latin America and North Africa, and stable or increasing rates of decline in Asian countries where DHS have been conducted. The Picture varies in sub-Saharan Africa, and stable or increasing rates of decline has probably slowed in Nigeria, and increased in Senegal and perhaps in the Sudan. In the remaining sub-Saharan countries, the trend is unclear (2).

sub-Saharan Africa experiences rates of infant and child mortality higher than any other region of the world.

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The under-five mortality rates of the sub-Saharan African countries ranges from 64 in Zimbabwe to 184.6 per 1000 in Mali (3). Examining the level and trend of childhood mortality of Ethiopia, during the 1971-82 period there has been a steady decline in childhood mortality among males in both rural and urban Ethiopia. However, for females this decline is less visible (4). Under five mortality rate for the year 1984 was estimated to be 159.9 and the estimate for the urban part of the country (134.6)

was lower than that of the rural (162.4) (4) and it was 119.5 per 1000 for Addis Ababa (5). In areas where there is no vital registration system, the only way of obtaining information apart from census is to conduct sample surveys. Estimates of basic demographic parameters from a sample survey is done most of the time using indirect techniques. In particular, mortality estimations are based on data from a number of sources and collection systems; and various analytical techniques are used. To a significant extent the estimates are based on childhood survivorship data and indirect estimation technique. It is generally true that estimates of under-five mortality are considered to be more reliable than the separate estimate for infancy or early child mortality (6). A number of indirect estimation techniques have been developed to estimate child mortality rates. However, in this paper the marital-duration based estimation of child mortality rates is employed.

Methods

Addis Ababa city is expanding, the old inner city and the peripheries have a marked difference in population density. The sampling procedure in this study considers these two parts of the city. The city is divided into Kebeles (Urban dweller's association) constituting the lowest administrative unit. In 1984, there were 179,169 married women in the city and there were also 284 Kebeles (10-15 Kebeles per Kefitegna) each consisting an average of 631 married women, and an average of 5.2 persons per household (5). Therefore, the target population of the study is all married women, according to the 1984 census. A cluster sampling design was adopted to select kebeles from the total of 284 Kebeles which has been initially stratified by density (inner and outer) and then a systematic sampling is used to select households to be included in the survey. The sample size is computed using EPI-ENFO with a 95% level of confidence and accordingly a sample of 1000 ever married women were included in the study. In this study the marital-duration-based estimate of child mortality is used and the analysis requires data on those women with marital duration of at most, 24 years. Out of the total 1000 ever married women included in the survey, 548 of them were with marital duration 0-24 years and the analysis is made solely on this group of women. The observations were collected by interview using a standard pre-coded questionnaire which was administered in Amharic. Data on duration of marriage is grouped into five categories; 0-4, 5-9, 1014, 15-19 and 20-24 years. A variant of the original Brass estimation procedure (Trussell's method), based on data classified by duration of marriage is employed to estimate the childhood mortality rates. The technique consists of calculating the proportion of children dead among children ever born by marital duration group of women and converting the proportion children dead to women of marital duration 0-4, 5-9, 10-14, 15-19, 20-24 years in to probability of dying between birth and ages 2, 3, 5, 10, and 15 years. The procedure is applied under the following assumptions: a/ The risk of dying of a child is a function only of the age of the child and not of other factors: b/ Fertility and child mortality have remained constant in the recent past: and c/ Women, once married, stay married until age 50 (the assumed upper limit of the potential reproductive life of a women). Therefore, the duration-based methods should strictly be applied only to data from currently married women still in their first union. However, in practice, no serious biases will arise when they are applied to data pertaining to all ever-married women as long as their marriage duration is calculated as the time elapsed since first marriage (6). Under these assumptions the procedure uses the following basic data in the estimation process:

- the number of children ever born (CEB_i) classified by sex and by the mother's five year durationof-marriage group duration of marriage being defined as the difference between age at first marriage and current age reported during the survey,
- the number of children dead, classified by sex and by the mother's five-years duration-of marriage group (CD_i) and,
- the total number of ever-married women in each five-year marriage-duration group (FP_i).

In the procedure q_x , the probability of dying between birth and age x, is estimated as a product of the proportion of children dead (D_i) and the corresponding multiplier generated for the West Model (K_i). Coel and Demeny published regional model life tables which consists of four sets of model life tables, labeled 'West', East', North' and 'South'. These sets are clearly of a regional character.

The West model is by far the most frequently used model life table. Coel and Demeny recommend its use when no reliable information on the age pattern of mortality is available and due to this reason the West model is used in this analysis (8).

$D_i=CD_i/P_i$ and $K_i=a_i+b_i*[P_1/P_2]+c_i*[P_2/P_3]$; where a_i, b_i and c_i are coefficients generated for the West Model and P_i is average Parity of the i^{th} duration (i=1,2,...5). In addition, the reference period, t_x, which is an estimate of the number of years before the survey to which the estimates of childhood mortality refer when mortality has been changing, is estimated by the equation, $t_x = a_i+b_i*[P_1/P_2] +c_i*[P_2/P_3]$ and it is important to note that the coefficients here are different from those used in the computation of K_i.

Result and Discussion

As indicated in Table 1 the average parity increases with duration of marriage. It ranges from 1.216 for those women with marital duration 0-4 years to 5.2 for women with marital duration 2024 years, and the proportion of children dead also increases with marital duration. The under-five mortality rate, q_5, (114/1000) is found to be slightly smaller than the 1984 estimate (119.5/1000). The value of q_3 (100/1000) is also smaller than the 1984 rate (104/1000) while q_2, the probability of dying before reaching exact age 2, has increased from 92.8 to 98 per 1000 (5). The reference dates indicate the time at which these rates refer to when mortality has been changing. Since the procedure assumes constant childhood mortality in the recent past, the Under-five mortality rate of 114/1000, for example, has remained constant for the past 6 years or since 1987 (Table 1).

By applying the same procedure, estimates of childhood mortality rates are generated for both sexes (Table 2). All the three estimates are found to be higher among the males. In 1984 the underfive mortality rates were 128.7 and 109.2 per 1000 for males and females, respectively (3). The 1984 estimate for males is found to be nearly similar to the current estimate (129/1000) while it is higher than the current estimate for females (99/1000). It should be taken also into consideration that the estimation procedure used in this study is different from that of the 1984 estimate. The 1984 estimate was based on data classified by age of the women. Therefore, the differences in the mortality rates between the two periods might be influenced by the type of methodology employed in each of the surveys. It should also be noted that, the duration-based estimates indicate lower mortality than do the age estimates, but the differences are very moderate (6).

One can, therefore, safely conclude that childhood mortality remains high in Addis Ababa. Research results have shown that infant and child mortality rates have been reduced substantially in the developing world in recent decades. However, in some of the sub-Saharan African countries, including Ethiopia, the trend of childhood mortality is unclear (2). Sub-Saharan Africa experiences rates of infant and child mortality higher than any other region of the world. The Under-five mortality rates of the sub-Saharan African countries ranges from 64 in Zimbabwe to 184.6 per 1000 in Mali (3). Examining the level and trend of childhood mortality of Ethiopia, during the 1971-82 period there has been a steady decline in childhood mortality among males in both rural and urban Ethiopia. However, for females this decline is less visible (4). In 1984 the under-five mortality rate for Addis Ababa was 119.5 and this rate has been higher than the current rate by 6 deaths per 1000. This indicates that there is a slow rate of decline in under five mortality rate in the City during the last decade. However, it is hard to say much about the trend of child mortality of the City since the only ready available documented information to compare with is the 1984 census result.

Concern has been expressed recently that the pace of decline in infant and child mortality in developing countries has slowed in the decade of the 1980s. This concern is based on a number of factors including economic crisis, limited access of populations to public health interventions, and the impact of AIDS (2). Hence, in depth study is suggested in order to explore the possible reasons for such high mortality level in Addis Ababa. Among some of the health status indicators of children in

Ethiopia, mortality due to vaccine preventable diseases (16%), mortality due to diarrheal disease (46%), immunization coverage (below 20%) and low birth weight (13%) (7) are considered to be the most important factors contributing a lot to the high level of child
mortality in the country. Therefore, some major child health intervention programs including vaccination against infectious disease, monitoring the growth and development of children by periodic weighing and examination, supervision of children's health in school and encouraging the community to participate in the health care program together with an integrated family planning service should be strengthened in order to reduce child mortality rate in Addis Ababa. In addition, it is equally important to evaluate the effectiveness of some of the already existing child survival programs.

Table 1: **Estimates of childhood mortality rates implied by the west model life table, Addis Ababa, March 1993.** Table 1: **Estimates of childhood mortality rates implied by the west model life table, Addis Ababa, March 1993.**

Duration of marriage	PF_i	CED_i	CD_i	P_i	D_i	K_i	x	q_x	t_x	Reference Date
0 - 4	37	45	4	1.216	0.088	1.124	2	0.098	1.412	1991.9
5 - 9	65	178	18	2.738	0.101	0.998	3	0.100	3.717	1986.6
10 - 14	110	441	50	4.009	0.113	1.007	5	0.114	6.199	1987.1
15 - 19	148	659	86	4.452	0.131	1.028	10	0.134	8.675	1984.6
20 - 24	188	980	136	5.212	0.138	1.005	15	0.138	11.56	1981.7

$P_1/P_2 = 0.444$
$P_2/P_3 = 0.683$

Table 2: **Estimates of childhood mortality rates between male and female children implied by the west model life table life table, March 1993.**

Sex	q_2	q_3	q_5
Male	0.105	0.107	0.129
Female	0.081	0.83	0.099
Both sexes	0.098	0.100	0.114

Acknowledgement

We would like to acknowledge the National Research Institute of Health for Providing financial and technical support. Our thanks is also extended to Ato Girmay Zerom for providing us with valuable materials.

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