Childhood Mortality Levels and Trends in Kenya: New Estimates Based on the Own Children Method

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Background

Researchers in Kenya – as elsewhere in Sub-Saharan Africa where demographic data are limited and defective – rely on indirect approaches to provide childhood mortality estimates to the ever increasing variety of users. Brass technique (Brass et al. 1968; United Nations 1983) is often the most widely used procedure for this purpose, and continues to revolutionize childhood mortality estimation among other less-developed regions of the world as well (Preston, Heuveline, and Guillot 2001). Two fundamental assumptions of the Brass technique – of constant fertility and mother-child mortality independence – are violable by the ongoing fertility transitions and the high prevalence of HIV/AIDS observed in many countries. On the one hand, evidence from the Demographic and Health Surveys (DHS) and other sources shows that many countries in Sub-Saharan African – including Kenya – have experienced somewhat dramatic fertility declines since the 1980s (Brass and Jolly 1993; Foote, Hill, and Martin 1993; Caldwell, Orubuloye, and Caldwell 1992). On the other hand, the advent of HIV/AIDS, particularly its high prevalence, is known to have resulted in high correlation between child survival and mothers' health and mortality status. Additionally, it is argued that high HIV/AIDS prevalence has changed the age pattern of mortality, which has mitigated the usefulness of the Coale-Demeny model life tables for estimating mortality. This poses a serious challenge to the contemporary application of the technique.

This study focuses on obtaining new, robust estimates of childhood mortality using methods that circumvent these violable assumptions. It uses an alternative method proposed by Preston and Palloni (1977) – hardly ever used for this purpose in Sub-Saharan Africa, but which overcomes the problems associated with changing fertility – to re-estimate childhood mortality levels and trends in Kenya.

The own-children method

The *own-children method* – also known as the *surviving children technique* – is a partial birth history reconstruction procedure linking all living children in a household to their biological mothers by the latter's age at birth. Unlike the traditional Brass technique, the own children method facilitates estimation of childhood mortality rates without making assumptions about the recent fertility patterns. It is a partial birth history reconstruction procedure that links surviving children recorded on the household schedule of a census or survey to their biological mothers. Once matching is achieved the children are back-projected by age until the reported number of children ever born is reproduced. The following equation, adapted from Preston and Palloni (1977), summarises the procedure for modeling childhood mortality based on the own children method:

$$\frac{B}{S} = \int_0^{\alpha} \frac{c_s(a)}{p(a)} da \quad \text{..(1)}$$

In this equation B and S are the total children ever born and surviving respectively; $p(a)$ is the life table probability of surviving to age *a;* $c_s(a)$ is the proportion of surviving children aged *a* at the time of interview; and α is the number of years since the birth of the first child to reporting women.

Now, most censuses (and surveys) data contain records of children ever born (*B*) and surviving (*S*), while $c_s(a)$, the age distribution of surviving children, can easily be obtained from the household roster. Thus, the only unknown in equation (1) is the *p(a)* function. If one, for instance, assumes that *p(a)* belongs to a given one parameter model life table system, there can only be a unique mortality level that matches the $\frac{B}{S}$ and $c_s(a)$ functions. Once found, *q(x)* values can easily be determined from that system, sometimes through interpolation.

One of the great advantages of the own children method over the Brass technique, therefore, relates to its ability to map out the fertility history of reporting women by way of the $c_s(a)$ function, which helps to resolve the *p(a)* [or *q(x)*] function without requiring assumptions on the recent fertility patterns. The technique was originally applied to fertility estimation (see, for instance, Cho, Retherford, and Choe 1986), but it has also been applied successfully for the estimation of childhood mortality rates (see Preston and Haines 1991 1984).

Data and methods

We apply the technique to data from four decennial Kenyan censuses (1969 to 1999) examine the trends in childhood mortality rates. Census data are preferable because they provide nationally representative estimates. Additionally, they have a great potential for making robust sub-national or areal estimates, which is important for countries like Kenya with regionally diverse demographic and socio-economic conditions.

Matching of children to their biological mothers is done at the household level, and facilitated by the “Relationship to Head of Household” codes, and the age difference between mother and child, which must fall within the reproductive age span. Matching software developed by the East-West Centre is available for this purpose. Opiyo and Levin (Forthcoming) have already obtained the mother-child matrices for these censuses (see Table 1, for example), which we have used in this study. The values of *p(a)* are obtained from the North family of the Coale and Demeny (1966) model life table system. We have confined the analysis to children of younger women in order to mitigate potential biases occasioned by out-migration of older children. The final estimates are adjusted for the impact of HIV/AIDS using the INDEPTH Model Life Tables for Sub-Saharan Africa.

Table 1. Mother-child matrix based on the 1999 Population and Housing Census

Age of	Total	CEB	CS	Total	Age of children (completed years)					
women	women				0	1	2	3	. . .	14
15	378,554	29,036	25,109	14,396	4,098	3,385	3,268	3,645		
16	349,226	56,736	48,999	22,626	7,502	4,382	3,752	3,404		
17	331,434	80,260	70,485	39,145	14,419	7,842	5,649	4,335		
18	357,733	152,102	134,894	82,235	28,824	16,792	13,172	8,662		
19	291,122	165,259	147,416	99,690	32,989	20,365	16,723	10,862		
20	401,298	394,519	348,673	239,304	60,975	42,391	41,780	32,378		
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45	136,088	924,599	789,819	206,155	3,507	4,345	6,105	7,593		23,956
46	66,979	462,922	389,215	99,828	1,575	1,897	2,787	3,386		11,789
47	83,522	590,668	497,157	117,838	1,616	2,032	2,874	3,702		14,169
48	69,222	485,003	407,493	87,178	1,246	1,595	2,122	2,589		11,382
49	65,359	462,741	386,073	77,220	1,081	1,345	1,777	2,169		10,189
Non own				2,592,479	98,864	119,216	136,273	147,023		221,867
Total					899,271	760,508	877,171	888,701		727,124

Note: CEB – children ever born; CS – children surviving

Results

The new estimates are considered robust because they are purged of biases associated with the contemporary application of the traditional Brass method, and give plausible trends across censuses. They suggest that greatest increase in childhood mortality risk attributable to HIV/AIDS – of about 10 percent – occurs at age 5, and that HIV/AIDS does not have any discernible impact on the age pattern of childhood mortality. The own-children method also renders unnecessary the use of other adjustment strategies – such as the hypothetical cohort method – that require data from more than one source. Needless to emphasize, improving quality of reporting in censuses, particularly with respect to age and linking children to their biological mothers – the two major challenges inherent in Africa data – can greatly improve the estimates.

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