Adult Mortality in the Pre-HIV/AIDS Era Cameroon

Martin Bangha (University of Pennsylvania)

Considerable efforts and resources in most developing countries and Cameroon in particular, have been justifiably devoted to the study of mortality at the lower extreme ages where mortality risks are known to be particularly high. This is also based on the conventional wisdom that investing in the health and well-being of children is an investment in the future development of the population. In recent years, adult mortality has been recognized as a serious threat to child survival and welfare. Increasing literature on the dynamics of poverty requires a better understanding of prime-age adult mortality because of the potential effects on household behavior and welfare. For instance, recent evidence suggest that children who have lost their parents are at risk for worse schooling and health outcomes (Case et al. 2004; Case and Ardington 2006; Ainsworth et al. 2005). Moreover, a better understanding of the adult mortality situation is crucial for health and development planning, since human capital is highly specialized, scarce and not easily replaceable.

Many African countries lack conventional data for systematic assessment of adult mortality. Following on the pioneering work of Brass (1975), substitute techniques have been developed for measuring adult mortality in data deficient contexts. These methods, however, have not been extensively tested and so, are not as widely accepted as the birth histories approach used for childhood mortality analysis. Meanwhile, several rounds of African censuses have progressively collected requisite information for these techniques like household deaths 12 months to census and have not been systematically analyzed. Recently one of the proponents and pioneer of these substitute techniques has initiated a review of the death distribution techniques for performance and sensitivity of estimates (Hill and Cho 2004) to the use of different age ranges for adjustment (Hill and Thomas 2007). In the initial phase of this evaluation, they have opted first for testing the methods under ideal circumstances where requisite data are essentially complete. This paper extends the evaluation of the techniques to a particular setting where requisite data are believed to be essentially incomplete.

Cameroon is typical of many African countries where basic indicators of health and mortality are frequently unavailable. Studies of mortality in Cameroon have mainly been

concerned with infant and child survival, while levels and structure of adult mortality have rarely been investigated. One major challenge in recent years is the mounting prevalence of HIV/AIDS that has severely jeopardized survival chances. According to current statistics by the UNAIDS (2006), Cameroon has been experiencing one of the more serious epidemics in Central Africa. The first documented AIDS cases in Cameroon were in 1987 (MSP et OMS 1989). Based on pregnant women at antenatal clinics, the current adult prevalence rate is about 11% while a recent household survey estimated that national HIV prevalence in 2004 at 5.5% (UNAIDS 2006). Despite strong interest in, and common wisdom about the impact of HIV/AIDS on adult mortality, absence of conventional and reliable data severely constrains attempts to quantify deaths attributable to AIDS. Moreover, an understanding of the structural impact of this pandemic requires some information on mortality prior to the onset. It is the goal of the current paper to provide this baseline assessment adult mortality in Cameroon.

Specifically, Hill's (1987) variant of the death distribution methods, applicable to non-stable populations is applied to the 1976 and 1987 census data. Based on the adjustment factors obtained, the reported household deaths and census counts are adjusted to produce corresponding life tables for Cameroon. Also, we examine the direct estimates to see how well they compare with similar estimates from recent sources. To assess the performance of the technique, the potential implication of several assumptions (in relation to the coverage of household deaths) on possible estimates of adult mortality is examined.

Data and Methods

One notable effort to improve the data environment in Africa is the African Census Analysis Project (ACAP) that has complemented efforts of various international organizations and governments through the creation of a unique data archive. This effort has helped prevent the disappearance (due to poor storage) of the 1970 and 1980 rounds of African censuses, and these censuses have become increasingly available. Cameroon provides an ideal case for the application of the death distribution techniques because the two available censuses consistently collected information on household deaths. The first two censuses of Cameroon (1976 and 1987) included a direct question on deaths in the household during the 12 months preceding the census; recording the age and sex of the deceased. These constitute the mortality inputs for our analysis. A total of about 104,000 household deaths were recorded during the 12 months prior to the 1987

census; with about 40% of all deaths pertaining to children under age five. Similarly, 79,308 household deaths were reported for the 12 months prior to the 1976 census; 45.9% of them being children under age 5.

To apply the generalized growth balance method, an estimate of the overall intercensal deaths is required. The deaths are estimated by combining the two-census age distributions with the household deaths reported 12 months prior to each census. The resultant ASMR from each census are assumed to prevail all through the intercensal period and applied to the person-years lived to obtain the deaths. The basic demographic balancing equation which holds in any closed population (see Hill 1987 and UN 2002 for details on the derivation) applies equally to a segment of the population over any given age x such that:

$$r(x+) = b(x+) - d(x+)$$

Where r(x+), b(x+) and d(x+) are respectively, the growth rate, birth rate, and death rate of the population segment age x and above. Birth rate in this case refers to the ratio of the people attaining age x during the reference period to the total person-years lived by the population age x and above. According to model propose by Hill (1987), the basic accounting equation can be transformed to into rates by the following formula:

$$\frac{N(x)}{PYL(x+)} - r(x+) = \frac{D(x+)}{PYL(x+)}$$

Where PYL(x+) is the true person-years lived by age x and above, r(x+) is the true population growth rate at aged x and above, D(x+) is the true total deaths at ages x and over. N(x) denotes the number of persons reaching exact age x (or celebrating their x^{th} birthday) during the interval and is estimated geometrically by interpolation of persons in the 5-year age groups x-5 to x, and x to x+5 of the two census distributions. By comparing the two sides of the above equation, we estimate the relative completeness of reported household deaths. The calculations are extended to the evaluation of the two successive censuses.

Considering that the first documented AIDS cases in Cameroon were in 1987 (MSP et OMS 1989), this paper provides a baseline assessment of the adult mortality situation in Cameroon. Cameroon provides an ideal case for such a study because the first two censuses consistently collected information on household deaths which will serve as mortality inputs. Using several diagnostics in conjunction with the death distribution methods, the quality of census data is assessed, and then the reported household deaths and census counts are adjusted to produce

corresponding life tables by sex for Cameroon. Three sets of adult mortality estimates are generated on the basis of some assumptions that provide a sort of confidence for the intercensal mortality conditions: One set of estimates will be based on household deaths reported for the 12 months 1986-87 under the assumption that the resultant age-specific mortality rates (ASMR) are observed all through the intercensal period, another set is based on a similar assumption for 1976 ASMR, and last one is based on same for the average ASMR for the two years (1976-1987).

Preliminary Findings

Table 1 presents the observed and adjusted probabilities (45Q15) which are further broken down into the conditional probabilities of dying between age 15 and 40 (25Q15) and between age 40 and 60 (20Q40). This should allow for a comparison of young adult mortality to that of older adults. On the whole, the adjusted estimates suggest that under the 1987 mortality conditions, about 37% of Cameroon males reaching age 15 were unlikely to celebrate their 60^{th} anniversary. A slightly smaller proportion is obtained for females (32%), which imply a 15% excess adult male mortality relative to adult female mortality. As expected the mortality risk increase generally with age from age 15 but the slope is steeper after age 40. The probability of dying between ages 40 and 60 is almost twice that between age 15 and 40.

The corresponding life tables based on the adjusted mortality conditions (ASMR) for 1976 and 1987 are presented in Tables 2a and b. The average expectation of life at age 15 (e_{15}) was almost similar for both sexes (about 47.3 years as against 47.9 for females) under the 1976 mortality conditions. The corresponding estimate based on the 1987 conditions suggest a slight sex difference of about 2 years in favor of an improvement females (50.2 years) while that of males remained virtually at the same level (47.9 years) all through the intercensal period. Since this is a cumulative measure of mortality there are signs of a slight general increase in life expectancy for males when measured as average remaining years at age 5 (e_5). It increased from 54.4 to 56.0 years while the increase for women is relatively more (from 55.2 to 58.3 years). Generally the sex differences in average remaining years turn to narrow towards the higher ages.

Two nationwide surveys conducted as part of the worldwide effort, the Cameroon Demographic and Health Surveys (CDHS II and III) in 1998 and 2004 have collected sibling survival information. A comparative assessment of these data alongside similar data for other African countries by Timaeus and Jasseh (2004) estimates the probability of dying between ages

15 and 60 around 1995 at 28% and 23% for Cameroon men and women, respectively. These estimates are evidently low relative to those presented above; which is perhaps an artifact of the methodological and data differences. The estimates from the 1998 and 2004 survey should normally correspond to the periods 1989-1998 and 1998-2004, respectively. However, comparing the direct estimates from the censuses and the CDHS, we observe that the 1987 age-specific mortality rates are slightly higher than rates for 1989-1998 though lower than the rates for 1998-2004. A consistent observation, though, is the general indication of male excess mortality.

Table 1. Probability of Dying for Adults between Exact Ages 15 and 60 (45Q15), Young Adults between Exact Ages 15 and 40 (25Q15), Old Adults between Exact Ages 40 and 60 (20Q40) by Sex, Cameroon 1976-1987

Indicator and Method of Adjustment	Males			Females		
	Source of Deaths Data			Source of Deaths Data		
	1987 Census	1976 Census	Average. 1976-87	1987 Census	1976 Census	Average. 1976-87
25Q15						
Observed	0.1150	0.0964	0.1067	0.0988	0.0929	0.0960
GGB adjusted	0.1312	0.1428	0.1371	0.1206	0.1528	0.1331
BH adjusted	0.1253	0.1387	0.1320	0.1143	0.1489	0.1277
20Q40						
Observed	0.2426	0.1944	0.2204	0.1921	0.1633	0.1788
GGB adjusted	0.2738	0.2800	0.2778	0.2316	0.2616	0.2433
BH adjusted	0.2626	0.2726	0.2683	0.2204	0.2553	0.2341
45Q15						
Observed	0.3297	0.2721	0.3035	0.2719	0.2411	0.2576
GGB adjusted	0.3691	0.3828	0.3768	0.3243	0.3745	0.3440
BH adjusted	0.3549	0.3735	0.3649	0.3095	0.3662	0.3318

Source: Calculations based on the 1976 and 1987 censuses of Cameroon

Consistent with the adjusted estimates presented earlier, the observed estimates also suggest little or no improvement in the adult mortality in Cameroon over the last two decades of the 20th century. The situation seems to have deteriorated or stagnated even prior to the onset of the HIV/AIDS pandemic. Based on this comparison of earlier rates with the CDHS estimates, there is some indication of an overlap of the ages for which mortality apparently increased though this differs for males and females. The increase for males seems to be more pronounced in the age range 30-45 years and in the age range 20-35 years for women. These ages correspond

to the peak productive and reproductive adult years which are also known to be the AIDS years, where the impact tends to be most pronounced. However, it should be noted that the indication of a pronounced increase at these ages is mostly portrayed by the recent DHS survey conducted in 2004. With sample size issues and other data limitations, more information (from other sources) on adult mortality risks in the country are needed before any conclusive statements can be drawn from these trends on the current levels.

Discussion and Conclusions

These results suggest that the population experienced stagnating adult mortality during the period 1976-87. Disaggregated by sex, they suggest that adult female mortality temporarily improved over the intercensal period. The female mortality advantage translates to a difference of less than three years in the expected remaining years of life at age 15. The estimated probabilities of dying between ages 15 and 60 imply an overall 15% excess adult male mortality relative to female mortality. This seems consistent with both national and international efforts to curb maternal mortality through the institution and implementation of safe motherhood and maternal and child health (MCH) programs during the period covered by these censuses.

The relatively poor performance of the Cameroon economy during the early to mid-1980s following the boom of the 1970s, and the dramatic changes in employment opportunities and other related political changes might have contributed to this stagnation.[1] It is most likely that the mortality risks and, probably, morbidity, increased as a consequence of the economic hardships, worsening of living conditions and mounting unemployment. A comprehensive attempt to assess the demographic response to economic shocks in Latin America (Hill and Palloni 1992) shows that recession has some expected adverse effects on mortality of vulnerable groups like women. However, in the case of Cameroon it is possible that men were more responsive to these socio-political and economic shocks of the early 1980s because they *were* traditionally the breadwinners, political and economic actors. Moreover, the negative effect on women might have been cushioned by the corresponding worldwide efforts during this era to curb maternal and child mortality.

[1] The economic depression that emerged during the early to mid 1980s developed into political crisis in the early 1990s, and was further aggravated by the devaluation of the CFA Franc in 1994, accompanied by the two successive salary slashes. In effect, Cameroon happens to be the only country (among a dozen former French colonies in Central and West Africa using the common currency, FCFA) where civil servants had to support the heavy weight of the franc devaluation alongside huge salary cuts. Other neighboring countries rather increased salaries to counter the effect of this devaluation.

Table 2a. Male and Female Life Tables Based on Adjusted 1987 Deaths: Cameroon

	Males				Females			
Age group	ASMR $_5m_x$	Probability of dying $_5q_x$	Survivors to age x l_x	Life expectancy e_x	ASMR $_5m_x$	Probability of dying $_5q_x$	Survivors to age x l_x	Life expectancy e_x
0-4	0.0313	NA	NA	NA	0.0282	NA	NA	NA
5-9	0.0046	0.0228	1.0000	56.0	0.0041	0.0203	1.0000	58.3
10-14	0.0029	0.0145	0.9772	52.2	0.0027	0.0136	0.9797	54.5
15-19	0.0038	0.0189	0.9630	47.9	0.0037	0.0182	0.9664	50.2
20-24	0.0049	0.0244	0.9448	43.8	0.0040	0.0199	0.9488	46.1
25-29	0.0053	0.0260	0.9218	39.9	0.0048	0.0237	0.9300	41.9
30-34	0.0066	0.0322	0.8978	35.9	0.0060	0.0295	0.9079	37.9
35-39	0.0077	0.0376	0.8689	32.0	0.0071	0.0349	0.8812	34.0
40-44	0.0114	0.0553	0.8362	28.1	0.0100	0.0486	0.8505	30.1
45-49	0.0137	0.0660	0.7900	24.6	0.0110	0.0537	0.8091	26.5
50-54	0.0199	0.0946	0.7378	21.2	0.0158	0.0760	0.7657	22.9
55-59	0.0193	0.0922	0.6680	18.1	0.0156	0.0750	0.7075	19.6
60-64	0.0372	0.1702	0.6064	14.7	0.0310	0.1440	0.6544	15.9
65-69	0.0366	0.1677	0.5032	12.2	0.0297	0.1384	0.5602	13.2
70-74	0.0722	0.3058	0.4188	9.2	0.0623	0.2695	0.4827	9.9
75+	0.1404	-----	0.2908	7.1	0.1306	-----	0.3526	7.7

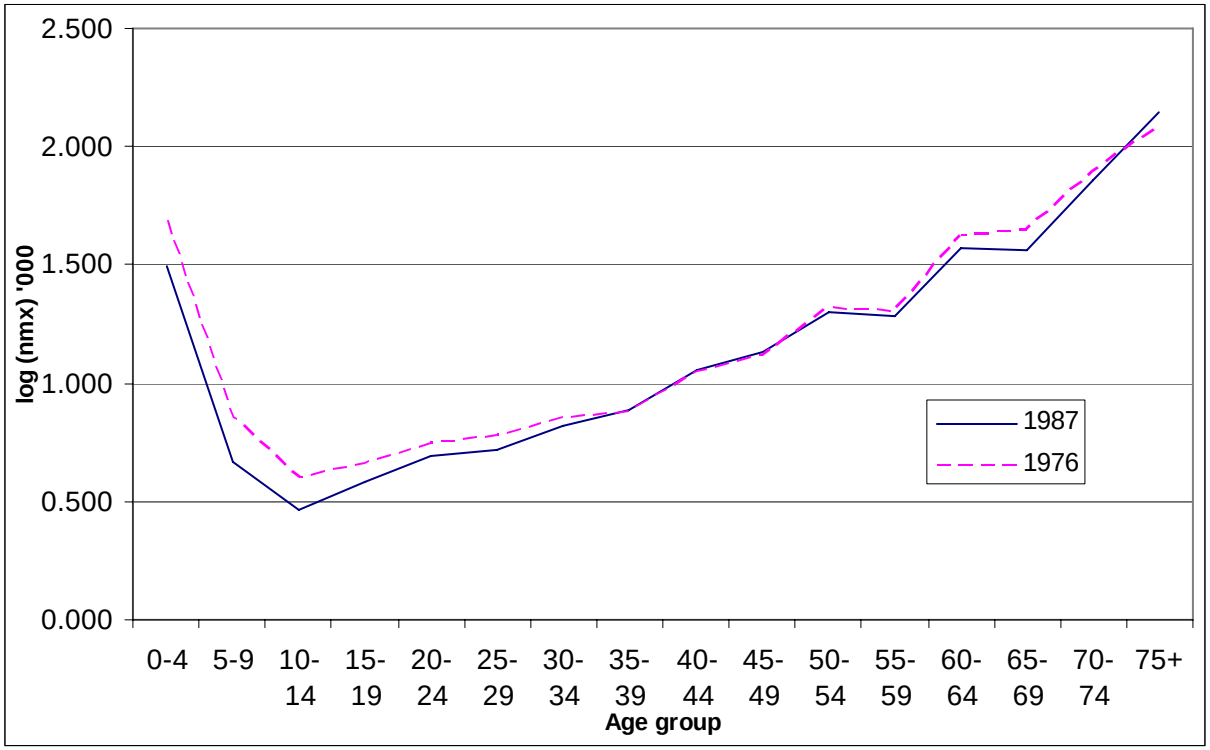
Source: Calculations based on the 1976 and 1987 censuses of Cameroon

Table 2b. Male and Female Life Tables Based on 1976 Deaths: Cameroon

	Males				Females			
Age group	ASMR $_5m_x$	Probability of dying $_5q_x$	Survivors to age x l_x	Life expectancy e_x	ASMR $_5m_x$	Probability of dying $_5q_x$	Survivors to age x l_x	Life expectancy e_x
0-4	0.0492	NA	NA	NA	0.0469	NA	NA	NA
5-9	0.0071	0.0348	1.0000	54.4	0.0062	0.0304	1.0000	55.2
10-14	0.0040	0.0198	0.9652	51.3	0.0043	0.0214	0.9696	51.8
15-19	0.0046	0.0227	0.9461	47.3	0.0046	0.0228	0.9488	47.9
20-24	0.0055	0.0272	0.9246	43.3	0.0055	0.0269	0.9272	43.9
25-29	0.0060	0.0293	0.8995	39.4	0.0065	0.0321	0.9023	40.1
30-34	0.0072	0.0352	0.8731	35.6	0.0084	0.0412	0.8733	36.3
35-39	0.0075	0.0368	0.8423	31.8	0.0083	0.0408	0.8374	32.8
40-44	0.0113	0.0547	0.8113	27.9	0.0109	0.0529	0.8033	29.1
45-49	0.0131	0.0636	0.7669	24.4	0.0119	0.0577	0.7608	25.6
50-54	0.0209	0.0993	0.7181	20.8	0.0200	0.0952	0.7169	22.0
55-59	0.0202	0.0960	0.6468	17.9	0.0182	0.0869	0.6487	19.0
60-64	0.0421	0.1905	0.5848	14.5	0.0356	0.1634	0.5923	15.6
65-69	0.0444	0.1998	0.4734	12.3	0.0406	0.1843	0.4955	13.1
70-74	0.0775	0.3246	0.3788	9.8	0.0654	0.2809	0.4042	10.6
75+	0.1210	-----	0.2559	8.3	0.1149	-----	0.2907	8.7

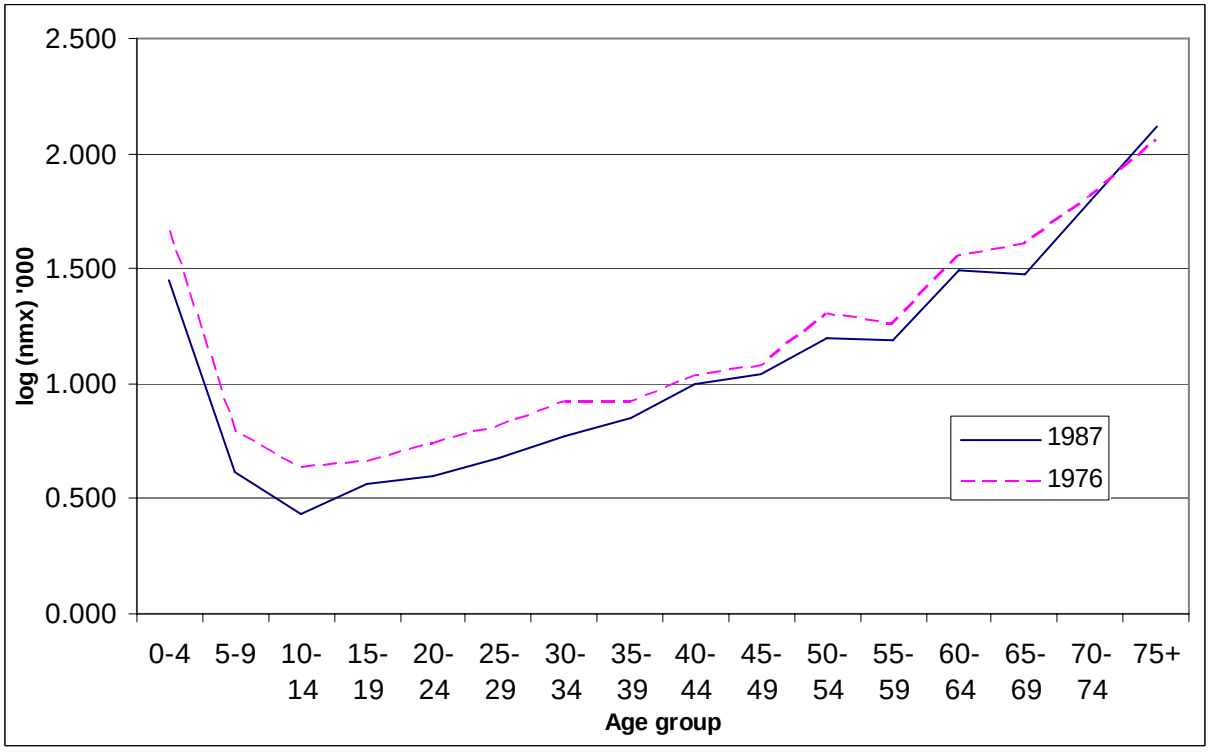
Source: Calculations based on the 1976 and 1987 censuses of Cameroon

Figure 1a: Male Adjusted Age-Specific Mortality Rates (Household Deaths in 1976 and 1987): Cameroon



Source: Calculations based on the 1976 and 1987 census.

Figure 1b: Female Adjusted Age-Specific Mortality Rates (Household Deaths in 1976 and 1987): Cameroon



Source: Calculations based on the 1976 and 1987 census.

References:

Ainsworth, M., K. Beegle, and G. Koda. 2005. "The Impact of Adult Mortality and Parental Deaths on Primary Schooling in North-Western Tanzania." *Journal of Development Studies* 41(3):412-439.

Bennett, N. and S. Horiuchi. 1984. "Mortality Estimation from Registered Deaths in Less Developed Countries." *Demography* 21(2):217-233.

Bhat, P.N. Mari. 2002. "General Growth Balance Method: A Reformulation for Populations Open to Migration." *Population Studies* 56(1):23-34.

Brass, William. 1975. *Methods for Estimating Fertility and Mortality from Limited and Defective Data.* Chapel Hill: University of North Carolina Press.

Case, Anne, C. Paxson and J. Ableidinger 2004. "Orphans in Africa: Parental Death, Poverty, and School Enrollment." *Demography* 41(3):483-508.

Case, A. and C. Ardington. 2006. "The Impact of Parental Death on School Outcomes: Longitudinal Evidence from South Africa." *Demography* 43(3):401-420.

Fogel, R.W. 2004. *The Escape from Hunger and Premature Death 1700-2100: Europe, America and the Third World.* Cambridge: Cambridge University Press.

Fotso, M. et al. 1999. *Enquête Démographique et de Santé, Cameroun 1998.* Bureau Central des Recensements et des Etudes de Population et Macro International Inc., Calverton, Maryland.

Hill, A. 1993. "Trends in Childhood Mortality." *Demographic Change in Sub-Saharan Africa.* National Research Council, Washington, DC: National Academic Press: 153-217.

Hill, K. 1987. "Estimating Census and Death Registration Completeness." *Asian and Pacific Population Forum* 1(3): 8-13 & 23-24.

Hill K. and A. Pebley. 1989. "Child Mortality in the Developing World." *Population and Development Review* 15(4):657-687.

Hill, K. and A. Palloni. 1992. "Demographic Response to Economic Shocks: The Case of Latin America." Proceedings of the IUSSP Conference on *The Peopling of the Americas*, Veracruz 1992 Vol. 3:411-437.

Hill K. and B. Queiroz 2004. "Adjusting General Growth Balance Method for Migration." Paper presented to the AMDC Meeting, Berkeley. July 2004.

Hill, K. and Y. Choi. 2004. "Death Distribution Methods for Estimating Adult Mortality: Sensitivity Analysis with Simulated Data Errors." Paper presented to the AMDC Meeting, Berkeley. July 2004.

Hill, K. and K.J.A. Thomas. 2007. "Evaluating the Performance of Death Distribution Methods for Estimating Death Registration Completeness: Applications to Data from High Income Countries." Presented at the *Annual Meetings of the Population Association of America* New York March 29-31.

Hill, K., R. Pande, M. Mahy and G. Jones. 1999. *Trends in Child Mortality in the Developing World: 1960 to 1996*. New York, United Nations Publications.

Institut National de la Statistique (INS) et ORC Macro. 2004. *Enquête Démographique et de Santé du Cameroun 2004.* Calverton, Maryland.

Ministère de la Santé Publique (MSP) et Organisation Mondiale de la Santé (OMS). 1989. "Revue du Programme Quinquennal de Lutte contre le SIDA." Yaoundé, Octobre-Novembre 1989.

Preston, S.H. 1975. "The Changing Relation between Mortality and Level of Economic Development." *Population Studies* 29(2):231-248.

Preston, S.H. and K. Hill. 1980. “Estimating the Completeness of Death Registration.” *Population Studies* 34(2):349-366.

Preston, S.H., P. Heuveline and M. Guillot. 2001. *Demography: Measuring and Modeling Population Processes.* Blackwell Publishers, Oxford.

Shryock, H.S., J.S. Siegel and Associates (eds.). 1976. *The Methods and Materials of Demography*. Condensed Edition, Academic Press, San Diego.

Timaeus, I.M. 1999. “Adult Mortality in Africa in the Era of AIDS.” *The African Population in the 21st Century*. Third African Population Conference, UAPS-NPU, Vol. II, pp. 377-395.

Timaeus, I.M. 1991. “Estimation of Adult Mortality in Less Developed Countries: A Comparative Review.” *Population Index* 57(4):552-568.

Timaeus, I.M. and M. Jasseh. 2004. “Adult Mortality in Sub-Saharan Africa.” *Demography* 41(4):757-772.

United Nations. 2002a. *Methods for Estimating Adult Mortality*. Population Division, DESA ESA/P/WP.175. Preliminary unedited version www.un.org (accessed October, 2006).

United Nations. 2002b. *International Migration Report 2002*. ST/ESA/SER.A/220, New York.

United Nations. 2004. *World Population Prospects: The 2002 Revision*. ST/ESA/SER.A/233, New York

UNAIDS. 2006. “UNAIDS/WHO AIDS Epidemic Update: December 2005 Sub-Saharan Africa 5” www.unaids.org/epi/2005 (accessed Dec 8, 2006).

Wilmoth, J.R. 2000. “Demography of longevity: Past, Present and Future Trends.” *Experimental Gerontology* 35(9):1111-1129.

Zuberi, T., A. Sibanda, A. Bawah, and A. Noumbissi. 2003. “Population and African Society." *Annual Review of Sociology* 29:465-486.