Old-age Mortality in sub-Saharan Africa: Evidence from Censuses and Surveys Estimates

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Abstract (250 mots)

Robust estimates of adult and child mortality are now available for sub-Saharan Africa, but few efforts have been devoted to estimating mortality among people aged 50 and above. The objective of this paper is to describe levels and age patterns of older adult mortality in this region of the world. The analysis covers 18 sub-Saharan African countries for which information is available on deaths by sex and age within households in two recent censuses or recent national surveys. We use death distribution methods to adjust mortality rates for incompleteness of death reporting.

Keywords

Mortality, Older Adult, Estimations, sub-Saharan Africa

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Background

The impact of child mortality on life expectancy is so significant that the considerable decline in child mortality in recent decades in Sub-Saharan Africa has led to substantial gains in life expectancy in this region (from 49 years in 1990 to 61 years in 2019 (United Nations, 2019) . However, child survival has not evolved in tandem with adult mortality, and there has been only modest progress in reducing mortality in adults aged 15-60. This is in part due to various health crises that affected the region during the 1990s, including the HIV/AIDS epidemic that has severely affected the adult population in some countries and led to surges in risks of dying. Mortality in older adults, aged 50 and above, has so far been poorly documented. Yet, most countries in the region do not have health systems adapted to the health needs of the older population. These countries also lack comprehensive systems of social security to facilitate the management of non-communicable diseases that are more prevalent in old ages(J. F. Fries, 1980; James F. Fries, 2000; Kehler, 2019). By the age of 50, there was already a significant burden of these diseases in some local sub-Saharan populations (Masquelier, Waltisperger, Ralijaona, Pison, & Ravélo, 2014; Soura, Lankoande, Millogo, & Bangha, 2014). In this context, an assessment of level and trends in mortality among the elderly, is necessary.

Objective

This work aims to analyse mortality levels of people aged 50 and over in the sub-Saharan region by using the most recent censuses and national surveys for which information is available on deaths by sex and age within households (over the 12 months prior to the data collection).

Specifically, the aim is to assess mortality levels of older women and men, to compare intercensal and survey data estimates for countries that have them and to analyse their consistency. Finally, we will confront age patterns of mortality contained in these estimates with those from other empirical sources referring to countries with high-quality vital registration to verify whether sub-Saharan African countries have an epidemiological trajectory similar to that observed in developed countries in the past in terms of the level older adult mortality.

Data and Methods

Data description

The data used cover 18 countries in the sub-Saharan region. With the exception of Central Africa, information on deaths by sex and age that occurred in enumerated households (in the 12 months prior to data collection) is available for these countries from the last two censuses. In all cases, the mid-census period coincides with the early 2000s, either from recent national surveys or from both types of sources. The data come from tabulations obtained from the United Nations Population Division of population size and deaths, by five-year age groups and sex. The countries and general population surveys concerned are listed in Table 1 below.

Table 1 : Censuses and surveys with data on recent deaths by sex and age recorded within households

Countries	Censuses	Surveys
Eastern Africa		
Ethiopia		2008
Malawi	1998, 2008	2010
Tanzania	2002, 2012	2007
Zimbabwe	2002, 2012	2005
Mozambique	1997, 2007	
Uganda		2006, 2011
Zambia		2007, 2008
Southern Africa		
Botswana	2001, 2011	2006
Lesotho	1996, 2006	2001
Namibia	2001, 2011	2006
South Africa	2001, 2011	2007
Eswatini	1997, 2007	2006
Western Africa		
Burkina Faso	1996, 2006	2007
Côte d'Ivoire		2005
Ghana		2007
Mali	1998, 2009	
Nigeria		2008, 2013
Senegal	2002, 2013	

Source: United Nations Population Division (2019), data extracted from the DemoData database, shared by P. Gerland.

Methodological approach

Adjustment for incompleteness of death reporting

Mortality rates are first adjusted for incompleteness of death reporting, using death distribution methods (Hill, You, & Choi, 2009). We use the “hybrid method”, which consists in applying the *Generalized Growth Balance* (GGB) method (Hill, 1987) to correct the relative coverage of the first census compared to the second, and then applying the *Synthetic Extinct Generation* (SEG) method (Bennett & Horiuchi, 1981, 1984) to assess and correct the completeness of intercensal deaths. This method can be applied to non-stable populations such as those in countries in the sub-Saharan region that have experienced significant demographic changes in recent decades. It also makes it possible to determine the correction factor necessary to adjust the first census to the second, thus by-passing the unrealistic assumption of similar census coverage underlying the original SEG method.

Despite this, two important assumptions remain to be satisfied, namely that of no migration and that of constant age completeness. Methods have been extended to take migration into account, but in the absence of reliable data on net migration, the assessment of completeness is made from age 40 onwards as recommended by Hill and colleagues to circumvent its disruptive effects on young adults. Completeness is adjusted by graphical analysis to the highest age limit at which significant age exaggerations are expected and which produces relatively constant levels of completeness.

Adjustment for age misstatement between 50 and 80 years

After adjusting for incompleteness, the census data will provide person-years by age group for the corresponding intercensal periods as well as the adjusted intercensal deaths required to calculate the mortality rates. In addition to census data, the analyses will combine person-years and death information directly from household surveys.

However, to compensate for the biases due to age exaggerations that are very often pronounced at older ages (Booth & Gerland, 2015; Palloni, Pinto, & Beltrán-Sánchez, 2016; Preston, Elo, & Stewart, 1999), particularly beyond age 70, the data will be adjusted by the Makeham model to age 65-70. In final step, the estimated parameters will be used to extrapolate to age 80 (Estimates beyond 80 years will not be considered here, because uncertainties are greater at these ages and the Gompertzian form of mortality patterns beyond 80 years of age is still debated (Barbi, Lagona, Marsili, Vaupel, & Wachter, 2018; Boleslawski & Tabeau, 2001; Feehan, 2018; Gavrilov & Gavrilova, 2011; Horiuchi & Wilmoth, 1998; Saikia & Borah, 2014).

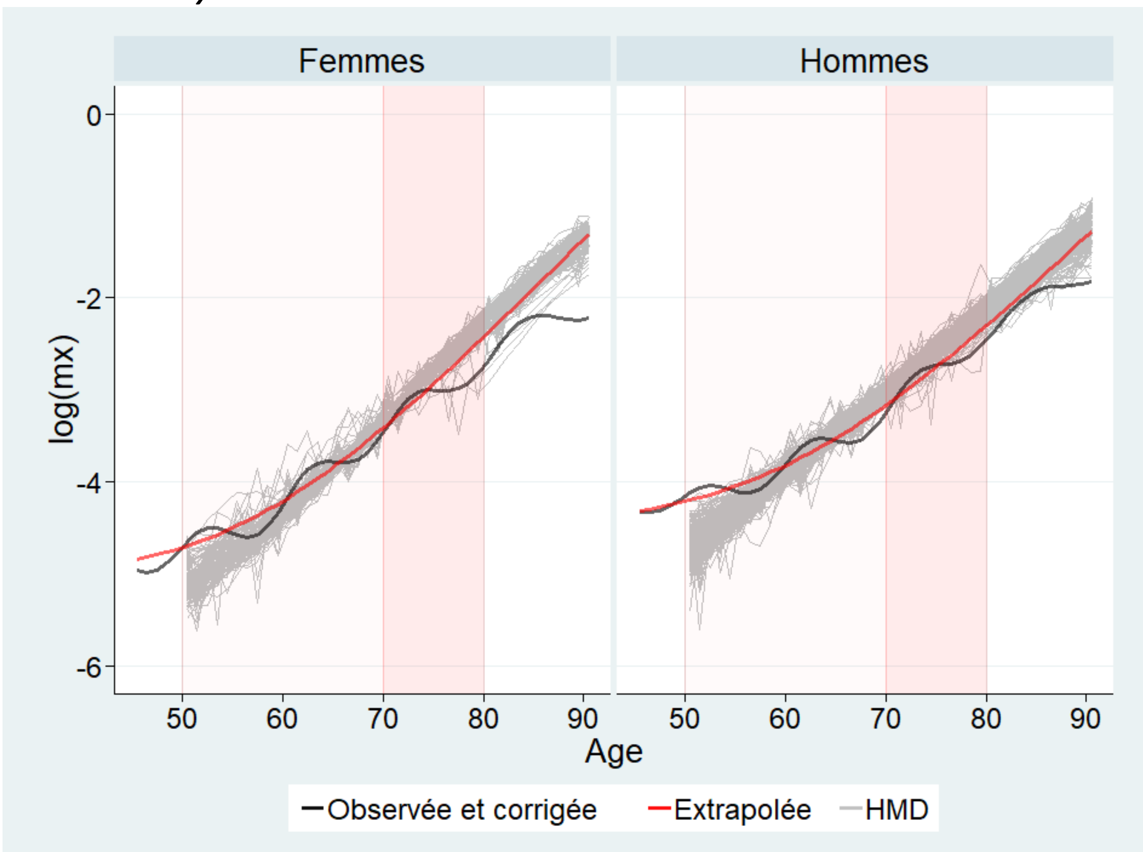
One of the problems in implementing this approach is the small number of points to be used to estimate the model parameters before any extrapolation. The Makeham model only adjusts the data well when more than 30-35 years of data are available. With data structured by age group, there would be very few estimation points on the 30-70 age group to derive robust parameters with a model that has three. To overcome this deficiency, person-years and intercensal death rates will be disaggregated by age year using the Penalized Composite Link Model (PCLM) (Rizzi, Gampe, & Eilers, 2015; Rizzi et al., 2016). It is a non-parametric model that allows grouped data to be disaggregated to obtain smoothed data by age year while preserving the age structure of the initial data. Graphical analyses will ensure that the disaggregated data are properly adjusted to the initial aggregate data.

Preliminary results

The preliminary analyses carried out as part of this work focus on Burkina Faso, in the intercensal period 1996-2006. As shown in Figure 1, the snake-like appearance of the adjusted elderly rates reflects the effect of attractions at round and semi-round ages. When these data are adjusted with the Makeham model and extrapolated beyond age 70, the adjusted trend presents a fairly clear deviation from the unadjusted rates, from age 75 upwards, especially for women. This deviation could be due to age exaggerations. When compared with empirical data from the Human Mortality Database (HMD), using country-years that had similar levels of life expectancy at age 50 as those observed in Burkina Faso, it appears that the patterns observed in Burkina Faso are in line with patterns already observed in the past, even if the curve has a less regular appearance and also differs from empirical data beyond age 75. On the other hand, the extrapolated curve based on Makeham reflects empirical data even beyond age 75.

These initial analyses will be extended to several other sub-Saharan African countries, particularly those severely affected by HIV, in order to draw lessons on the consistency of age-specific mortality patterns in these countries with those derived from empirical data. This work is a contribution to filling the scientific gap on mortality of older people in the sub-Saharan region, in particular to get an idea of the levels and patterns of mortality in this region and to identify possible differences with historical data.

Figure 1 : Age-specific pattern of mortality above 50 years of age in Burkina Faso and in the Human Mortality Database



Source : Estimates from the authors

References

Barbi, E., Lagona, F., Marsili, M., Vaupel, J. W., & Wachter, K. W. (2018). The plateau of human mortality: Demography of longevity pioneers. *Science*, *360*(6396), 1459–1461.

Bennett, N. G., & Horiuchi, S. (1981). Estimating the completeness of death registration in a closed population. *Population index*, 207–221.

Bennett, N. G., & Horiuchi, S. (1984). Mortality estimation from registered deaths in less developed countries. *Demography*, *21*(2), 217–233.

Boleslawski, L., & Tabeau, E. (2001). Comparing theoretical age patterns of mortality beyond the age of 80. In *Forecasting Mortality in Developed Countries* (p. 127–155). Springer.

Booth, H., & Gerland, P. (2015). Demographic techniques: data adjustment and correction. In *International Encyclopedia of the Social and Behavioral Sciences* (Second Edition, Vol. 6, p. 126-137). Oxford: Elsevier.

Feehan, D. M. (2018). Separating the signal from the noise: Evidence for deceleration in old-age death rates. *Demography*, *55*(6), 2025–2044.

Fries, J. F. (1980). Aging, natural death, and the compression of morbidity. *The New England journal of medicine*, *303*(3), 130–135.

Fries, James F. (2000). Compression of morbidity in the elderly. *Vaccine*, *18*(16), 1584–1589.

Gavrilov, L. A., & Gavrilova, N. S. (2011). Mortality measurement at advanced ages: a study of the Social Security Administration Death Master File. *North American actuarial journal*, *15*(3), 432–447.

Hill, K. (1987). Estimating census and death registration completeness. *Asian and Pacific population forum/East-West Population Institute, East-West Center*, *1*, 8–13. The Asian & Pacific Population Forum.

Hill, K., You, D., & Choi, Y. (2009). Death distribution methods for estimating adult mortality: sensitivity analysis with simulated data errors. *Demographic Research*, *21*, 235–254.

Horiuchi, S., & Wilmoth, J. R. (1998). Deceleration in the age pattern of mortality at olderages. *Demography*, *35*(4), 391–412.

Kehler, D. S. (2019). Age-related disease burden as a measure of population ageing. *The Lancet Public Health*, *4*(3), e123–e124.

Makeham, W. M. (1860). On the law of mortality and construction of annuity tables. *Journal of the Institute of Actuaries*, *8*(6), 301–310.

Masquelier, B., Waltisperger, D., Ralijaona, O., Pison, G., & Ravélo, A. (2014). The epidemiological transition in Antananarivo, Madagascar: an assessment based on death registers (1900–2012). *Global health action*, *7*(1), 23237.

Palloni, A., Pinto, G., & Beltrán-Sánchez, H. (2016). Estimation of Life Tables in the Latin American Data Base (LAMBdA): Adjustments for Relative Completeness and Age Misreporting. *United Nations Expert Group Meeting New York*, *3*.

Preston, S. H., Elo, I. T., & Stewart, Q. (1999). Effects of age misreporting on mortality estimates at older ages. *Population studies*, *53*(2), 165–177.

Rizzi, S., Gampe, J., & Eilers, P. H. (2015). Efficient estimation of smooth distributions from coarsely grouped data. *American journal of epidemiology*, *182*(2), 138–147.

Rizzi, S., Thinggaard, M., Engholm, G., Christensen, N., Johannesen, T. B., Vaupel, J. W., & Lindahl-Jacobsen, R. (2016). Comparison of non-parametric methods for ungrouping coarsely aggregated data. *BMC medical research methodology*, *16*(1), 59.

Saikia, P., & Borah, M. (2014). A comparative study of parametric models of old-age mortality. *International Journal of Science and Research*, *3*(5).

Soura, A. B., Lankoande, B., Millogo, R., & Bangha, M. (2014). Comparing causes of death between formal and informal neighborhoods in urban Africa: evidence from Ouagadougou Health and Demographic Surveillance System. *Global health action*, *7*(1), 25523.

United Nations. (2019). *World Population Prospects* (The 2019 Revision). Consulté à l'adresse https://population.un.org/wpp/