Assessing Levels and Trends of Adult Mortality in Sub Saharan Africa Using INDEPTH Health and Demographic Surveillance Systems Data

Martin Bangha, George Wak & Osman Sankoh
(On behalf of the INDEPTH Network)
Accra Ghana

Introduction

Mortality levels are key indicators of population health and very crucial to prioritize public health and/or effective allocation of resources. According to Jha (2012), counting the death is one of the world’s best investments to reduce premature mortality. However, majority of the deaths occurring in Sub Sahara Africa (SSA) still go unrecorded. Indeed, data from the UNSD database and World Health Statistics for 2012 (UNSD 2015) show that coverage of vital events and particularly deaths is very low (below levels that can be considered reasonable for analysis) except for South Africa, Egypt, Mauritius and Seychelles where all, or nearly all, deaths are captured.

It must be recognized that over the last 2 decades, efforts towards monitoring the Millennium Development Goals (MDGs) has increased the availability of national level data across Africa. In particular, there have been well over 130 censuses conducted between 1985 and 2014, with most countries respecting the recommended 10-year intercensal interval (UNSD 2015); over 110 Multiple Indicator Cluster Surveys (MICS) conducted in about 44 African countries between 1995 and 2014 (UNICEF 2016 http://mics.unicef.org/); over 160 Demographic and Health Surveys (ICF International 2016: http://www.dhsprogram.com/) conducted in about 45 African countries between 1990 and 2014; and over 27 Living Standard Measurement Study (LSMS) surveys conducted in 11 African countries (World Bank 2015).

Obviously, these multiple national data sources have been extremely useful in providing various demographic indicators but data deficiency (coverage, completeness, timeliness and regularity) in SSA remains a major problem in current efforts at setting public health priorities and tracking of progress towards national and global goals (from MDGs to the current Sustainable Development Goals – SDGs). Indeed, there is still a considerable dearth of knowledge regarding
adult mortality and premature deaths. With very few countries able to maintain a reasonably functional civil registration and vital statistics (CRVS), knowledge of the adult premature mortality remains somewhat scanty. This data deficiency constraint is compounded by a methodological challenge as the adult mortality measurement approach is not really as robust as the birth histories approach widely used for childhood mortality analysis (Hill et al. 2005; Hill and Pebley 1989; Preston et al. 2001). Moreover, adult mortality is a rather infrequent event even in high mortality populations (Preston et al. 2001). Attempts to measure adult mortality using censuses and cross-sectional surveys rely mainly on indirect techniques that are affected by common biases or by the likelihood that assumptions underlying the development of these techniques no longer hold in contemporary LMICs.

This, therefore, calls for new and innovative ways of measuring demographic events, particularly adult mortality in poor settings where the burden of disease (BoD) and mortality is not only highest but majority of the deaths occur outside the health care facilities. The growing number of Health and Demographic Surveillance Systems (HDSSs) grouped under the INDEPTH Network offer a temporary solution to the paucity of knowledge regarding adult mortality and premature deaths in LMICs and SSA in particular. The INDEPTH Network is an international organization that coordinates the activities of Health and Demographic Surveillance Systems (HDSSs) in mainly remote areas in Africa, Asia and Oceania, with majority of them located in SSA. With a current membership of 46 centres running 53 HDSS field sites, the INDEPTH members collectively monitors a population of over 4.0 million people annually and generate on continuous basis vital information on population and health dynamics of small well-defined geographic areas within their respective countries. An important aspect of the INDEPTH HDSSs is the harmonization and standardization of research tools and the strong collaboration among the individual sites. This, no doubt tend to enhance the quality of data and also allows for comparative analysis.

Data and Methods
Data for this analysis come from 16 INDEPTH member HDSS centres across nine countries in Africa that have contributed at least eight years of data, from 2005 to 2012. The INDEPTH Network launched in 2013 the INDEPTHStats (online data visualization platform) and the INDEPTH Data Repository (an online data archive) of fully documented, harmonized high-
quality longitudinal datasets from INDEPTH member HDSS centers (Herbst et al. 2015). These HDSSs are located within three geographical regions in SSA (South, East and West) and are considered accordingly in this analysis. From East Africa, we have Kilifi, Kisumu and Nairobi in Kenya; Magu and Rufiji in Tanzania and Iganga-Mayuge in Uganda. Specific HDSSs contributing data for this analysis from Southern Africa are Agincourt, Africa Centre and Dikgale in South Africa; Karonga in Malawi and Manhica in Mozambique. From West Africa, we have Farafenni in The Gambia; Kintampo and Navrongo in Ghana and Mlomp and Niakhar in Senegal.

The selected HDSSs provide a good geographic representation of SSA except for the Central (middle) Africa region where there is yet no HDSS running. All the 16 HDSSs selected for this analysis collectively monitors a total population of over 1.5 million people annually. The sizes of these HDSSs vary considerably, with the current population under surveillance ranging from a low of 8,200 for Mlomp in Senegal to a high of 280,000 for Kilifi. Table 1 below shows the selected HDSS and their respective population under surveillance. Descriptions of the selected HDSSs and the data collection are provided elsewhere (Alberts et al 2015, Crampin et al. 2012, Odhiambo et al 2012, Oduro et al. 2012, Tanser et al. 2007, Scott et al 2012, Kahn et al 2012, Delaunay et al. 2013, Sacoor et al. 2013, Beguy et al., 2015, Jasseh et al. 2015, Mrema et al. 2015, Kishamawe et al. 2015).

Despite some differences between the HDSSs, methods of data collection are similar across board and typically involve the monitoring of populations of a well-defined geographical area. Trained fieldworkers periodically visit each household to record demographic events that have occurred in these households and residential status since the last visit. Period of visit to households for information varies by HDSSs and ranges between once and three times in a year. For most of the HDSSs selected for this analysis, the regular updating of demographic events and residency status are conducted every 4 months (i.e. 3 times a year), though a few do annual updates or twice a year (every 6 months).

Vital events recorded and updated include births, deaths, in- and out-migrations, marital status and vaccination status of children under three years of age, among others. An important aspect of the HDSS is the conduct of verbal autopsies that is used for the determination of the main causes
of deaths of the population under surveillance. Data collected from the field either by using paper-based questionnaires or electronic data capture, are usually checked for consistencies and possible errors corrected before data entry takes place. In addition to individual HDSSs generating their demographic and health outputs according to needs, the INDEPTH-Network has developed a common platform/process to assist member centers with data extraction, harmonization, quality control, documentation using DDI (Herbst et al 2015) as well as the standardized computation of key demographic indicators.

Table 1: HDSS Population included in analysis

<table>
<thead>
<tr>
<th>HDSS/Region</th>
<th>Country</th>
<th>Surveillance Population</th>
<th>Available Data Years</th>
<th>Urban %*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kilifi</td>
<td>Kenya</td>
<td>281,816</td>
<td>2004-2012</td>
<td>22.2</td>
</tr>
<tr>
<td>Kisumu</td>
<td>Kenya</td>
<td>220,000</td>
<td>2003-2012</td>
<td>R-P</td>
</tr>
<tr>
<td>Nairobi</td>
<td>Kenya</td>
<td>67,901</td>
<td>2002-2012</td>
<td>U</td>
</tr>
<tr>
<td>Magu</td>
<td>Tanzania</td>
<td>34,347</td>
<td>1994-2012</td>
<td>50.2</td>
</tr>
<tr>
<td>Rufiji</td>
<td>Tanzania</td>
<td>105,503</td>
<td>1999-2012</td>
<td>30.6</td>
</tr>
<tr>
<td>Iganga/Mayuge</td>
<td>Uganda</td>
<td>79,794</td>
<td>2005-2012</td>
<td>R-P</td>
</tr>
<tr>
<td><strong>East Africa</strong></td>
<td></td>
<td>1,533,896</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Africa Centre</td>
<td>South Africa</td>
<td>90,065</td>
<td>2000-2012</td>
<td>38</td>
</tr>
<tr>
<td>Agincourt</td>
<td>South Africa</td>
<td>87,040</td>
<td>1993-2012</td>
<td>R</td>
</tr>
<tr>
<td>Dikgale**</td>
<td>South Africa</td>
<td>36,000</td>
<td>1996-2012</td>
<td>R</td>
</tr>
<tr>
<td>Karonga</td>
<td>Malawi</td>
<td>35,730</td>
<td>2003-2012</td>
<td>16</td>
</tr>
<tr>
<td>Manhica</td>
<td>Mozambique</td>
<td>95,000</td>
<td>2000-2012</td>
<td>15</td>
</tr>
<tr>
<td><strong>Southern Africa</strong></td>
<td></td>
<td>1,533,896</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Africa Centre</td>
<td>South Africa</td>
<td>90,065</td>
<td>2000-2012</td>
<td>38</td>
</tr>
<tr>
<td>Agincourt</td>
<td>South Africa</td>
<td>87,040</td>
<td>1993-2012</td>
<td>R</td>
</tr>
<tr>
<td>Dikgale**</td>
<td>South Africa</td>
<td>36,000</td>
<td>1996-2012</td>
<td>R</td>
</tr>
<tr>
<td>Karonga</td>
<td>Malawi</td>
<td>35,730</td>
<td>2003-2012</td>
<td>16</td>
</tr>
<tr>
<td>Manhica</td>
<td>Mozambique</td>
<td>95,000</td>
<td>2000-2012</td>
<td>15</td>
</tr>
<tr>
<td><strong>West Africa</strong></td>
<td></td>
<td>1,533,896</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farafenni</td>
<td>Gambia</td>
<td>51,391</td>
<td>1993-2012</td>
<td>61</td>
</tr>
<tr>
<td>Kintampo</td>
<td>Ghana</td>
<td>142,396</td>
<td>2005-2012</td>
<td>29</td>
</tr>
<tr>
<td>Navrongo</td>
<td>Ghana</td>
<td>156,000</td>
<td>1996-2012</td>
<td>20</td>
</tr>
<tr>
<td>Mlomp</td>
<td>Senegal</td>
<td>8,200</td>
<td>1990-2012</td>
<td>R-P</td>
</tr>
<tr>
<td>Niakhar</td>
<td>Senegal</td>
<td>43,713</td>
<td>1990-2012</td>
<td>R-P</td>
</tr>
</tbody>
</table>

Notes: * P, peri-urban; R, rural; U, urban (% TBD).

** Up to 2010 when it was expanded, Dikgale initially covered 8071 (Alberts et al. 2015)
Results
The results reveal distinctive mortality trends for the three regions of Africa, apparently consistent with the different diseases profiles observed in these regions over the period, with Southern and Eastern African countries predominantly afflicted with the HIV/AIDS pandemic. Based on the results, adult mortality is generally lower in the West African region than the other two regions. This is contrary to the higher mortality experienced in western Africa compared to southern and eastern Africa in the 1960s (Hill, 1991; Timaeus, 1991). Male mortality is generally higher than female in all the regions, except for Nairobi where females apparently seem to be experiencing higher mortality.

It is observed that the East African region experienced a general decline of mortality over the period under review. For instance, as shown in Figure 1, Kisumu with the highest adult mortality among the six HDSS, witness a sharp drop from a high of about 750 per thousand population in 2003 to about 450 in 2012. Similar results were noted in another study on mortality trends following the era of antiretroviral therapy in Kenya, where the largest mortality decline was observed in Kisumu (Reniers et al, 2014). The rapid decline in mortality has been likely due to the introduction and expansion of ART over the years (van't Hoog et al, 2012).

On the other hand most of the HDSSs in the southern Africa are among those with correspondingly highest adult mortality for both males and females. In particular, Africa Centre and Agincourt (all in South Africa) and Manhica (in neighboring Mozambique) are the HDSSs with the higher mortality for both males and females (Figure 2). Generally, the trend suggests an initial increase in mortality levels up to 2005 and then a slight decline thereafter. This initial increase in mortality for the HDSSs in Southern Africa is consistent with earlier concentration of people living with HIV/AIDS while the decline is equally consistent with the introduction of, and uptake of ART in South Africa especially, and Southern Africa in general (Simelela and Venter 2014; Shisana et al. 2014, Reniers et al. 2014)

For the West African region, a fluctuating but slow decline in mortality was experienced, particularly for the females. Among the sites in this region, Navrongo exhibits the highest mortality among the males and also for the females. Generally, female adult mortality is lower than male mortality for the selected HDSSs in West Africa. Another noticeable feature of the
female adult mortality trend in the region is the decline over the period, with some convergence for 2012 (Figure 3).

**Discussion and conclusion**

Demographic data for mortality analysis has improved over the past decade following the establishment of HDSS centres across Africa and Asia. This analysis has utilized data from several of these HDSS centres in Africa to compare the trends of adult mortality in Sub-Saharan Africa. While the sub region remains a high mortality region, the results have also revealed differences in the levels and trends of adult mortality among the various geographical regions of east, south and west. The existence of these differences can be attributed to the differences in the diseases burden of these regions and countries.

Results of all the sites selected for this analysis have shown excess male mortality as expected. However, the female excess mortality is experienced in the Nairobi site. This could possibly be attributed to the slum conditions in Nairobi for which females could be vulnerable to diseases. Further studies are needed to understand the causes of this higher female adult mortality in the Nairobi site.

Inertia has been one major reason why few data have been collected on adult deaths (Timaeus, 1999). Health intervention priority has not included adult mortality and this has led to scanty data on adult deaths for any meaningful analysis. However, with the advent of HDSSs analysis on adult mortality and their causes have become possible and offer the opportunity for the appropriate intervention to reduce the high rates.
Figure 1: Trend in Adult Mortality for HDSSs in East Africa, 2000-2012

1a: Male

1b: Female
Figure 2: Trend in Adult Mortality for HDSSs in Southern Africa, 2000-2012

2a: Male

2b: Female
Figure 3: Trend in Adult Mortality for HDSSs in West Africa, 2000-2012

3a: Male

3b: Female
References


Jha, Prabhat (2012), Counting the dead is one of the world’s best investments to reduce premature mortality. *Hypothesis* 10(1): e3, doi:10.5779/hypothesis.v10i1.254 (2012)


Simelela NP, Venter WDF. A brief history of South Africa’s response to AIDS. *S Afr Med J* 2014;104(3 Suppl 1):249-251. DOI:10.7196/SAMJ.7700


---

11


World Bank 2015. The Living Standards Measurement Study (LSMS) surveys  