

Original Article

Completeness of adult death registration in Sudan in 2002

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Abstract

Mortality rates are very important for decision making in public health and in measuring the burden of disease. In Sudan under-registration of adult deaths is expected. In the background of a study to measure the burden of disease in Sudan, adult death registration completeness was assessed using Brass Growth Balance method. Partial birth and death rates were calculated from registered deaths in 2002 and total mid-year population projections. Linear regression of partial birth rates on partial death rates was used to calculate the completeness of death registration. The analysis showed that only 4.4% of deaths were registered and registration completeness was more for male deaths (6.5%) than for female deaths (2.8%). A wide gap in mortality information in Sudan was found. This should be addressed by adequate sources of adult mortality information until a high quality vital registration system is constructed.

Key words: Death registration, Sudan

Background

Mortality rates in conjunction with other measures of population health play a very important role in informing decision making in public health, where they have a wide range of uses. These vary from general assessment of health system performance to the planning and evaluation of specific strategies and interventions. They are of particular importance in quantifying the total and cause specific burden of disease, where all cause mortality rates provide the frame that validates estimated cause specific mortality rates ⁽¹⁾. Ideally, all-cause and cause-specific mortality rates for the population would be provided by high quality national vital registration systems with death registration completeness of at least 70% ⁽²⁾. In Sudan only medically certified deaths are registered and some degree of under-registration is expected. Therefore it is important to

assess the completeness of death registration to provide evidence on the adequacy of the mortality data that it provides.

In the background of a study to measure the burden of disease in Sudan for 2002, it was necessary to assess death registration completeness for 2002, since that was not reported before. In this paper we report results of application of a demographic technique to assess adult death registration completeness in 2002, and discuss their implications and limitations.

Methods

Data: The data required was total mid-year population by 5 year age groups and total deaths registered by 5 year age groups. The 1993 census projections for 1998 and 2003 ⁽³⁾ were used to interpolate the total population in Sudan in 2002. Deaths registered in 2002 ⁽⁴⁾ were reported in broad

age groups; less than 1, 5–14, 15–24, 25–44, and 45+. They were disaggregated into 5 year age groups up to 45+, assuming that the death rate was the same within each broad age group.

Analysis: Brass Growth Balance method was used to assess adult death registration (5). The method is based on the finding that in a stable population, partial birth rates and partial death rates from registered deaths have a linear relationship described by the following equation:

$$N(x)/N(x+) = r + K * D(x+)/N(x+)$$

Where:

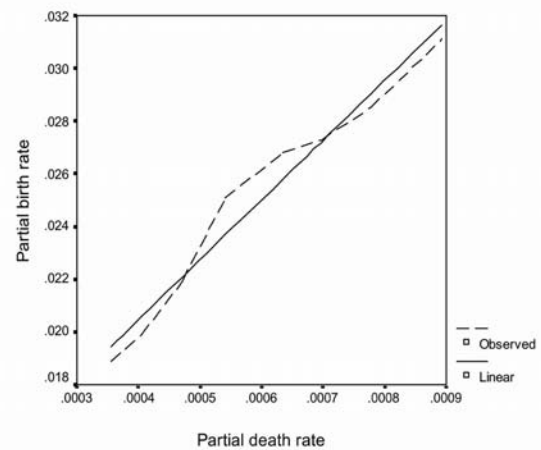
- N(x) is the population at exact age x.
- N(x+) is the population above age x.
- r = growth rate.
- K = correction factor for death under-registration.
- D(x+) = deaths above age x.
- N(x)/N(x+) = partial birth rate.
- D(x+)/N(x+) = partial death rate.

Partial birth and death rates for 2002 were calculated at exact age x where x = 5, 10, 15, 20, 25, 30, 35 and 40. Separate calculations were also made for males and females. Partial birth rates were plotted against partial death rates. The plots were examined, outliers were removed, and a linear model was fitted to each plot using SPSS. The inverse of the regression coefficient for each model gave the completeness of death registration, while the intercept provided an estimate of the growth rate.

Results

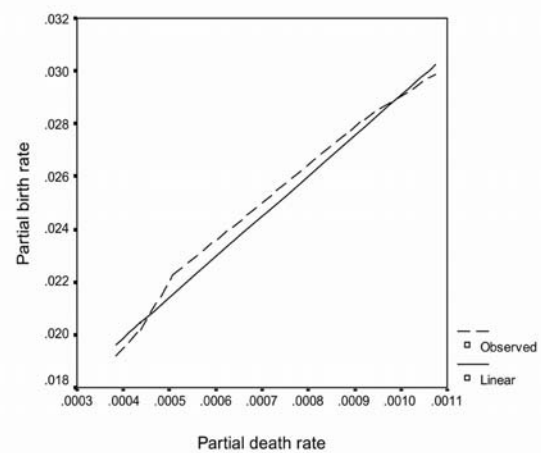
The plots and best fitting lines are shown in figures 1–3. Adult death registration completeness and estimated growth rates are displayed in table 1. Adult death registration completeness was 4.4% for all the population and was higher for males (6.5%) than for females (2.9%).

Figure 1: Partial birth rates versus partial death rates in Sudan population 2002



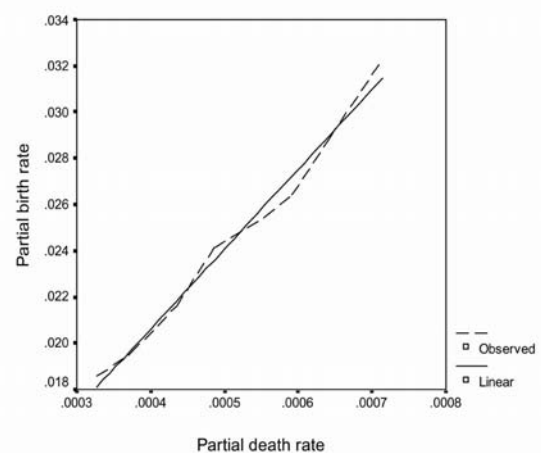
F = 173.78, p < 0.0001

Figure 2: Partial birth rates versus partial death rates in males in 2002



F = 283.45, p = 0.0005

Figure 3: Partial birth rates versus partial death rates in females in 2002



F = 405.91, p < 0.0001

Table 1: Adult death registration completeness and growth rates in Sudan in 2002

	Death registration completeness (%)	Estimated population growth rate
Males	6.5	0.014
Females	2.9	0.007
Overall	4.4	0.011

Discussion:

Only 4.4% of adult deaths in the population were reported in the health system in 2002. The under-registration could be partially but not conveniently explained by the fact that deaths were reported in that year from only 14 of the 26 states of Sudan. The most probable explanation for such marked under-registration is that a substantial proportion of deaths occurred outside health facilities and therefore went unrecorded. The calculations could have been restricted to the reporting states but the objective of this analysis was to quantify adult death under-registration in all the population. Moreover, limiting the analysis to reporting states would mean that any potential adjustments would be made for the reporting states only and would not provide mortality rates for all Sudan.

In the GBD 2000-2002 indirectly estimated life tables were used for Sudan. Cause specific mortality rates had to be calculated from compositional cause of death models⁽⁶⁾. Concern arose about the validity of using GBD results of cause of death distributions in local decision making⁽⁷⁾. It is worth noting that if the number of deaths estimated for Sudan in 2002 in the GBD (346200)⁽⁸⁾ were compared with the registered deaths, a very close result would be obtained (4.3%). This greatly supported the result of this study, but since both methods involved indirect techniques, it did not mean that they would consistently yield the same result, or that such gross death under-registration was adjustable using the Brass growth balance method.

The Brass Growth Balance method assumes a stable population (constant mortality and fertility over a long period of time and the same growth rate for all ages)⁽⁵⁾. The validity of the estimate of death registration completeness would be questionable if these conditions were violated, particularly the condition of constant mortality. In this analysis, the

difference between the estimated growth rate and the reported growth rate of 2.63%⁽⁴⁾ suggested possible violation of the assumption. The Bennett-Horiuchi and Generalized Growth Balance methods⁽⁵⁾ do not stipulate such conditions but they require 2 censuses. Since the last 2 censuses in Sudan were in 1983 and 1993, using these methods would not give a recent picture of the state of death registration completeness.

Uncertainty may arise from the assumption used to disaggregate the deaths reported in broad age groups. To determine the effect of this assumption on the result, the analysis was repeated with all combinations of extreme distribution scenarios. Whichever way deaths in the broad age groups were disaggregated, death under-registration could not be less than 2% or more than 8%. The upper value was still too low to render the reported mortality adjustable or reliable. Another source of uncertainty would be the use of population projections, which were not revised due to the lack of a recent census. Uncertainty could also result from age misreporting which is likely to occur in older ages⁽⁵⁾. With these uncertainties it would be difficult to determine if the difference in death under-registration between males and females was a true difference. The marked under-registration found in this study confirms the presence of a huge gap in adult mortality information in Sudan. This could negatively affect evidence based decision making in public health where planning and evaluation of strategies and interventions depend on mortality information. Indirect demographic techniques would have to be used. In an analysis of the performance of these techniques, Hill⁽⁹⁾ suggested a combined approach using both Generalized Growth Balance method and Bennett-Horiuchi method and favored the inclusion of a question on household deaths in censuses. In the context of burden of disease analysis for Sudan, the

reported cause of death distribution could not be used to derive cause specific mortality rates even if all cause mortality rates were adjusted. Mortality burden would have to be derived from case fatality studies, which carry their own limitations. Verbal autopsy methods for estimating cause specific mortality had widely varying sensitivities and specificities⁽¹⁰⁾, and adjusting cause specific rates using validation studies could be limited⁽¹¹⁾. The problem of the gap in adult mortality information was addressed by community surveillance projects in some developing countries^(12,13). An alternative to the vital registration system is the sample registration system that collects demographic and epidemiological data on a representative sample of the population and has been implemented in India and China⁽²⁾.

Conclusions

A gross proportion of deaths in 2002 in Sudan were unregistered. This created a wide gap in mortality information in Sudan, which will hinder evidence based policy making and will make burden of disease analysis a difficult task. The results quantified the problem of death under-registration in Sudan, and provided a baseline for comparison with assessments for subsequent years. Action should be taken to provide adequate sources of mortality information for Sudan. The experiences of other countries in this respect should be examined for possible adoption. The ultimate goal should be the construction of a high quality vital registration system, and death registration completeness in Sudan should be regularly appraised to drive action towards that goal.

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