MEASURING EXCESS MORTALITY ASSOCIATED WITH HIV: ESTIMATES FROM THE PHIA PROJECT

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BACKGROUND

Assessing national HIV epidemics requires accurate data on new HIV infections and HIV-related deaths. Mortality estimates are challenging in settings with incomplete vital statistics. Household surveys have been used across many settings to collect mortality information from residents and estimate mortality rates for specific times and locations.

We examined household-level mortality and biomarker-based HIV status to estimate excess mortality associated with national HIV epidemics using population-based data across 11 countries in sub-Saharan Africa. We compared mortality between individuals in households (HH) with and without people living with HIV (PLWH).

METHODS

We used publicly available data from 11 Population-based HIV Impact Assessment (PHIA) surveys conducted between 2015-2019 in Cameroon, Cote d'Ivoire, Eswatini, Kenya, Malawi, Namibia, Rwanda, Tanzania, Uganda, Zambia, and Zimbabwe. Heads of HH were asked to list all usual HH members and whether any had died in the 3 years before the survey. For each death reported, sex, age at death, and date of death were collected. Individual participants provided informed consent, answered questions, and provided blood for rapid HIV testing.

Primary outcome-number of reported deaths per 1,000 person years (PY) for 3-years before the survey. We measured mortality differences associated with documented HIV among HH members. Country-specific weighted deaths were calculated. We compared mortality differences by urban/rural status. Death rates were estimated with a household-level quasi-Poisson regression model with the number of deaths during the reporting period as the outcome. Jackknife survey weights were incorporated using the survey package in R 4.2.2.

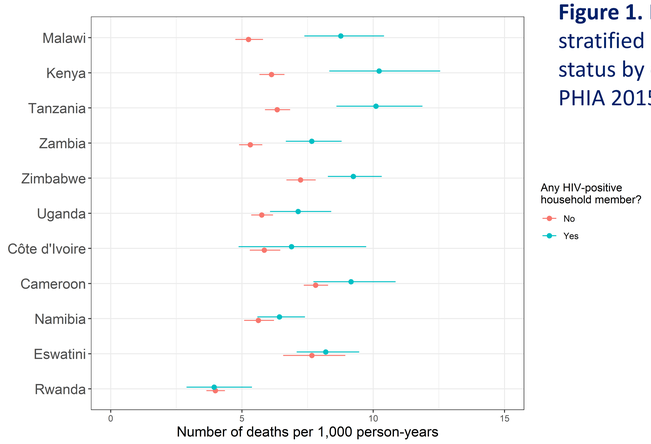


Figure 1. Death rates stratified by HH HIV status by country, PHIA 2015-2019

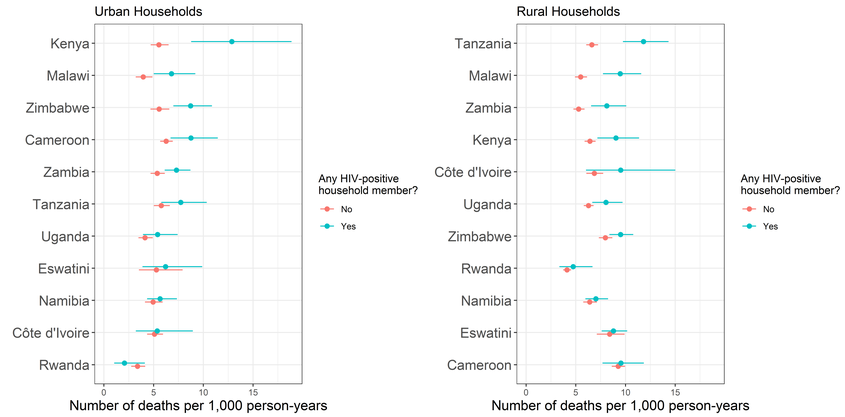
Population surveys ***combining biomarkers and questions about household deaths*** can be used to estimate ***excess mortality*** associated with HIV epidemics.

RESULTS

The number of responding HH in each survey ranged from 4,923 in Eswatini to 16,918 in Kenya. The percentage of HH reporting any deaths in the prior 3 years ranged from 5.1%-12.9%. Urban HH reporting any deaths in the prior 3 years ranged from 3.8% to 9.9%, while the percentage of rural HH reporting any deaths ranged from 5.6% to 15.9%. The estimated number of deaths per 1000 PY in the prior 3 years ranged from 4.0 (3.7-4.3) in Rwanda to 7.9 (7.5-8.4) in Cameroon and 7.9 (7.1-8.8) in Eswatini. When examining deaths per 1000 PY among HH with any PLHIV compared with HH without any PLHIV, we found that five of the countries had significantly higher death rates among HH with PLHIV **(Figure 1)**.

We examined HH deaths by urban vs rural status, and found death rates significantly higher, between 29% to 48% higher, among rural HH compared with urban HH per 1000 PY in five countries. When separate models were run for urban HHs and rural HHs with and without PLHIV, we found that three countries had urban HH and four countries had rural HH with any PLHIV with higher death rates than urban or rural HH without any PLHIV **(Figure 2)**.

Figure 2. HH deaths per 1,000 PY over 3 years before PHIA survey comparing HH HIV status stratified by urban/rural, 2015-2019



CONCLUSIONS

In this first description of mortality using PHIA data from 11 nationally representative surveys, we found that death rate patterns varied with about half demonstrating significantly higher death rates among HH with PLHIV compared with HH without PLHIV. A similar pattern emerged when stratifying by urban and rural HH, and interestingly, two countries, Kenya and Malawi also showed HH with PLHIV had significantly higher death rates than HH without PLHIV whether stratified by urban or rural.

These findings demonstrate the need for country-specific data to assess mortality trend as aggregate analyses may mask changing mortality patterns in individual countries. These findings suggest a new approach, which captures indirect effects of HIV on mortality of HH members, to track progress towards zero AIDS-related deaths.

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