**Causes of death among adults at the time of the COVID-19 pandemic in sub-Saharan Africa**

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## Introduction

There has been much speculation about the impact of COVID-19 on mortality in sub-Saharan Africa. Various reasons have been proposed as to why mortality was lower in the sub-continent during the pandemic than in other regions of the world. These include reasons such as genetic factors preventing severe illness, previous exposure to local circulating coronaviruses, protective public mitigation strategies, a lack of long-term old-age care facilities and a younger age structure (Adams et al. 2021). When considering why in South Africa higher mortality was noted, it has been suggested that it was an outlier, with a higher median age, high level of co-morbidities such as hypertension, diabetes, obesity and a heavy HIV and TB burden (Adams et al. 2021). A reason explaining both the exceptionality of South Africa, and the lower than expected mortality in sub-Saharan Africa is presumably the registration of deaths, testing and diagnostics – limited across countries but more reliable in South Africa where civil registration is commonplace.

Regular tracking of mortality in Africa is scarce, with limited civil registration and vital statistics (Mikkelsen et al. 2015). In particular, data on adult and old-age mortality, which were the hardest hit ages by COVID-19, is lacking (Ouedraogo 2020). Thus, to estimate the effect of COVID-19, excess death estimates were relied on. In measuring the undercount of the true mortality impact of COVID-19, using a ratio of excess mortality to reported COVID-19 mortality rate, high ratios in countries in sub-Saharan Africa were explained by the paucity of testing, medical practices and unclear guidance as to what should be counted as a death from the virus (Wang et al. 2022). While excess death estimates are valuable to understand the overall impact of the pandemic, the causes of deaths are not identified. It is likely that an increase in deaths is directly related to COVID-19 infection, but other changes in causes of death are also anticipated around the time of the pandemic. Notably, as policies were rolled out, such as social distancing or lockdowns, society changed, and with it, deaths from different causes. For example, “deaths of despair” increased during the COVID-19 outbreak, as suicide, drug and alcohol related mortality rose (Aburto et al. 2022). In rural Kenya, deaths from traffic accidents declined, despite an overall increase in all-cause mortality (Oduor et al. 2023). This was also seen in Peru (Calderon-Anyosa and Kaufman 2021). In contrast, increased maternal mortality was noted in many low- and middle-income countries, as women preferred to stay away from health facilities, ease of access was reduced or antenatal services were slashed (Calvert et al. 2021). Identifying changes in causes of death at the time of the pandemic can help in unpacking excess mortality. We leverage mobile phone surveys from three Africa countries to assess changes in causes of death from 2019 to 2022.

## Data & methods

The Rapid Mortality Mobile Phone Surveys (RaMMPS) is a survey programme designed to estimate mortality over the pandemic across five countries (Reniers 2022). This study uses the RaMMPS data

from Burkina Faso, Malawi and the Democratic Republic of Congo (DRC) which included modules of sibling survival histories and parental survival histories. The surveys in Malawi and Burkina Faso were nation-wide, and included 10,463 and 21,339 respondents respectively, while the survey in the DRC was limited to two provinces (Kinshasa and North Kivu), with 11,9924 respondents. Across the countries the survey interviews were held over mobile phones, amongst over 18-year olds.[1] Methods varied from country to country but all surveys asked the same questions about deaths of relatives, with additional information on causes of death for those that occurred between 2019 and the date of the interview.

From the RaMMPS surveys, it is possible to identify three causes of death. The first is maternal mortality, based on three questions (asked of deceased sisters or mothers) of whether she was pregnant when she died, whether she died during childbirth, or whether she died within two months of pregnancy or childbirth. The second is external deaths, based on two questions: whether the death was an accident or a result of violence. And the third cause is broadly defined as infectious, and is based on having at least one respiratory/flu or cold-like symptom from a list of ten options. Deaths from COVID-19 are included in this category, and may be roughly identified through questions on vaccination of the deceased, or whether the respondent thinks it is likely s/he died from the virus. We estimate COVID-19 deaths according to having one infectious symptom, not being vaccinated, and respondent thinking likely that death was related to the virus.[2] The remaining deaths for which we cannot identify a cause that occurred from 2019 on are included in the "other/unknown" category.

Preliminary results from Malawi and DRC

In Malawi a total of 13,736 deaths were reported in the sibling survival histories and parental survival histories combined (Table 1). Of these, deaths since January 2019 totalled 938, and we are able to identify a cause for 414 deaths.[3] In the DRC of the 1,432 deaths since January 2019, we identified a cause for 722 deaths, from the reported 12,116 sibling and parental deaths. We find a generally higher proportion of external deaths amongst both men and women in DRC as compared to Malawi – as expected due to the ongoing political instability and conflict, especially in the North Kivu province. Moreover, COVID-19 identified deaths are more common than in the DRC, where only 8% of deaths from infectious diseases amongst brothers, and 11% amongst sisters, could be classified as from COVID-19. In contrast, in Malawi, two thirds of deaths that are infectious-related reported amongst siblings are likely from COVID-19. These differences are most likely a reflection of differential vaccination roll-out between the countries (especially since more urban areas are covered in the DRC). It is also possible that COVID-19 is stigmatised by some in DRC, and respondents did not feel at ease to say they thought it likely a relative died from the virus.

[1] In Burkina Faso respondents were aged 15 and above.

[2] We will test for sensitivity of this assumption, with attention to the timing of the roll-out of vaccinations in each country.

[3] In comparing the mortality rates from the mobile phone surveys to other data sources, there appears to be some displacement of deaths outside the least three years, leading to under-estimation of deaths. While this reduces the number of deaths overall, since we do expect displacement to differ by cause of death, this should not bias our results.

*Table 1: Number of reported deaths in each country*

| | **Malawi** | **DRC** |
|---|---|---|
| ***Sibling deaths*** | 7,189 | 4,574 |
| ***Mother deaths*** | 2,459 | 2,744 |
| ***Father deaths*** | 4,088 | 4,798 |
| ***Total deaths*** | 13,736 | 12,116 |
| ***Deaths with identified cause*** | 414 | 722 |
| ***Deaths since 2019 with other cause*** | 524 | 710 |

Although we are left with a residual category of causes of death, this category is also informative. Overall, around 70% of deaths are of "other" reasons or unknown. We see that there was a decline in the proportion of these other/unknown deaths from 2019 to pandemic years (March 2020 – 2022) (Figures 1 & 2). This may be because respondents are more likely to report on a more recent death, or because this reflects a "true" increase in deaths from the identified causes. In Malawi, we see an increase in infectious deaths following the outbreak of COVID-19, amongst both men and women, as well as an increase in external deaths amongst men. In contrast, there is a decline in the proportion of external deaths amongst women in Malawi. In the DRC, the proportion of external deaths was lower before the onset of the pandemic, for both sexes, and in both provinces. However, the proportion of deaths related to infectious diseases declined for women and remained the same for men. We note a slight decline in maternal deaths – though considering there are few recent maternal deaths amongst mothers when respondents are adults, we do not read into this. Further analysis, including sisters' deaths will provide a better picture. All the same, it is worth noting that pre-pandemic, the proportion of maternal deaths in Figure 1 is comparable to those estimated for 2019 by the Institute for Health Metrics and Evaluation's Global Burden of Disease – 0.98% of deaths in Malawi, and 1.8% in DRC (IHME 2020).

*Figure 1: Female cause-specific mortality fractions, based on mother's survival histories, Malawi & DRC (2019-2022)*

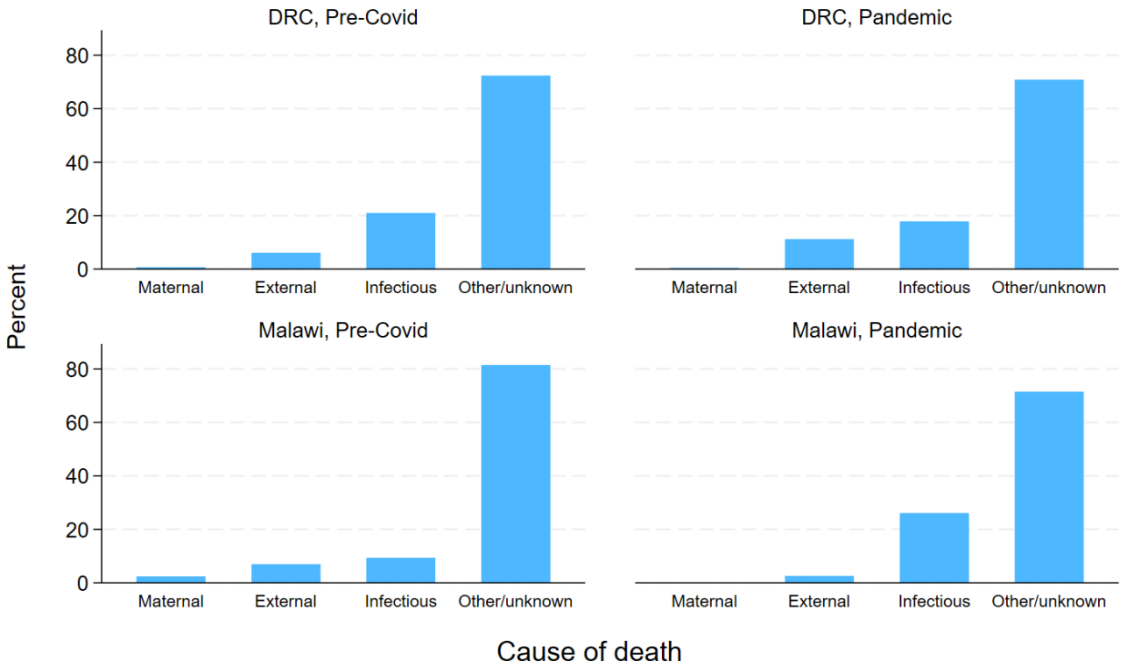
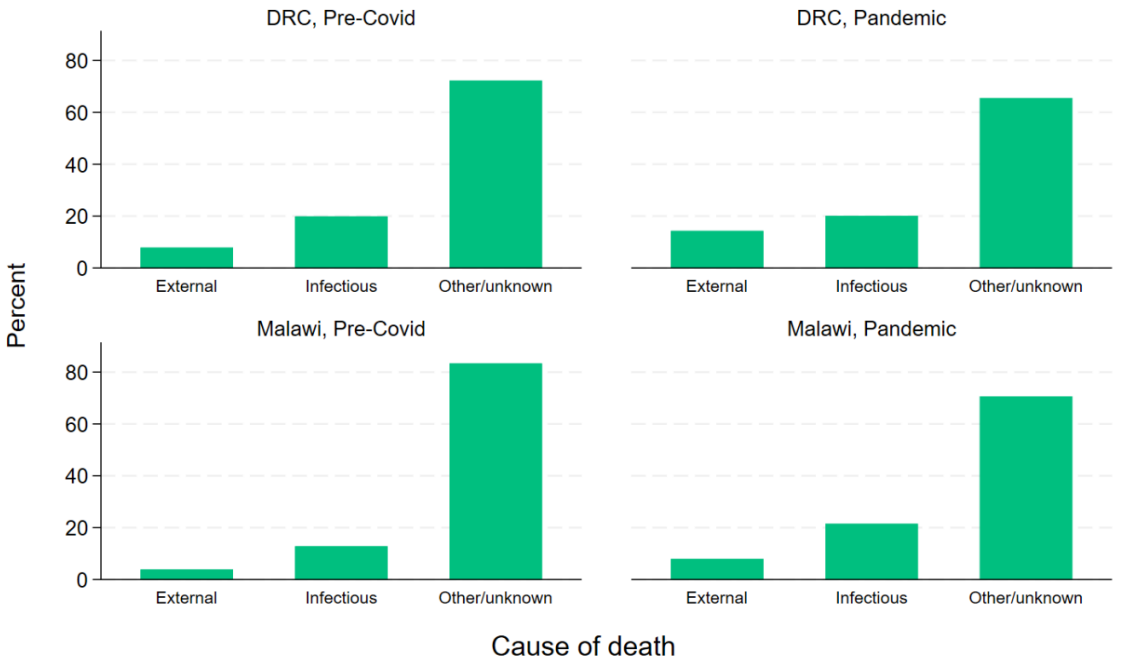


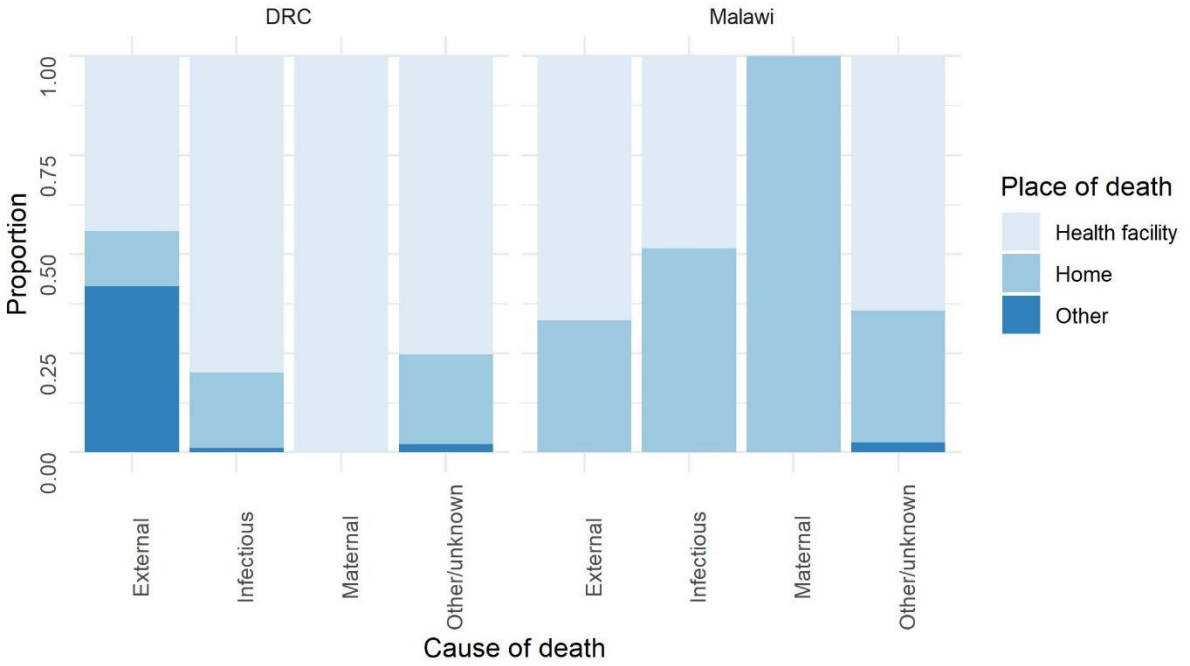

*Figure 2: Male cause-specific mortality fractions, based on father's survival histories, Malawi & DRC (2019-2022)*




With a question on location at time of death, it is further possible to examine the distribution of cause-specific mortality by place of death. In Figure 1, focusing on reports on mother's deaths, we note that a relatively high proportion of deaths from communicable diseases were in health facilities, especially in the DRC. As expected of external deaths, a number of deaths were in "other" locations in the DRC. Of other/unknown causes, around 75% of deaths in the DRC, and nearly 40% of deaths in Malawi were

in health facilities. The overall high proportion of deaths in health facilities in the DRC suggests that monitoring causes at health facilities could be quite representative particularly in urban areas,[4] while in Malawi a high proportion of deaths are at home, and monitoring causes in health facilities alone would provide a distorted picture.

*Figure 3: Mother's cause-specific mortality fraction by place of death, Malawi & DRC*




Our preliminary analysis highlights important changes in causes of death around the time of the pandemic in sub-Saharan Africa. However, we also face some limitations in analysis, such as selection bias, and causality. We are unable to pinpoint the reasons for changes in death patterns – while we can say this is likely COVID-19 related, in the DRC in particular, changes may be due to shifts in conflict/ politics. Moreover, since mobile phones surveys are not representative – respondents tend to be younger, male, more educated and live in urban areas, mortality estimates based on such surveys could be biased (Sánchez-Páez et al. 2023). Therefore, post-stratification weighting of results is planned to correct for this. Apart from using weights, further work will also include the survey from Burkina Faso, combining all deaths from parental and sibling modules, and disaggregating them by age group and sex, and sensitivity analysis.

[4] Of the two provinces covered in DRC, Kinshasa province basically covers the capital city and is therefore almost exclusively urban.

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