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Annexure 1: Correcting the NPR data for under-reporting of deaths

The South African Medical Research Council and University of Cape Town set up a Rapid Mortality Surveillance (RMS)[1] making use of death data from the National Population Register (NPR). As described by Dorrington and colleagues[2], these data are subject to two forms of under-reporting. The first (and smallest at 2–3% for all ages, although as high as 50% for deaths in the first year of life) is non-registration on the population register (because the deceased did not have a South African birth certificate or identity document). The second is the non-registration of the death (estimated to be about 12–13% for all ages, but about 25% for deaths in the first year of life and about 40% for those who died aged 1–4), a common challenge experienced in developing countries. For the RMS report[3], the annual numbers of these deaths by sex and age were adjusted to account for deaths not captured on the population register, and adjusted for under-registration to provide national estimates of the numbers of deaths. This annexure briefly summarises the description of adjustments made to the numbers of deaths to account for the under-reporting, which have been reported elsewhere.[2,3]

Completeness of the vital registration (VR) data for adults was estimated by the application of death distribution methods[4,5] to past VR data until 2017 and censuses/surveys from the 1980s to 2011. For infants and children, the completeness was estimated by comparison of infant and childhood VR data to estimates of the true numbers of deaths implied by infant and childhood mortality rates estimated from census and survey data. The data showed improvement in completeness of registration and we used a logistic curve to extrapolate trends to provide estimates of completeness for years beyond the data. Infant deaths reported by the VR system are estimated to be currently around 75% completely reported, those aged 1–4 about 60% complete and adult deaths 90–95% complete in recent years (i.e. post-2013).

A further adjustment must be made to the NPR numbers to account for the number of registered deaths that do not appear on the NPR. These are mainly deaths that occur before the birth was registered or deaths of non-South African citizens. Such deaths are not recorded on the NPR, but the registration forms are forwarded to Statistics South Africa for the production of the official vital statistics. From the historical trend in the ratio of NPR to VR deaths, we assume that the NPR deaths are 35%, 90% and 100% of the official civil registration and vital statistics infant, 1–4-year-old, and adult deaths, respectively. These estimates can then be applied to the numbers of VR deaths estimated from the numbers of deaths on the NPR to provide estimates of the true numbers of deaths by age and sex for the country as a whole.

As outlined by Dorrington and colleagues[2], the estimates of the true numbers of deaths by age and sex for the provinces have been derived by assuming that:

1. The VR unnatural deaths (whether in urban or rural areas) are completely reported.
2. The VR deaths (both natural and unnatural) in the eight metropolitan districts (metros) are completely reported.
3. The VR deaths (both natural and unnatural) in the non-metro district councils in which 70% or more of the population live in enumeration areas classified as ‘urban’ in the 2011 census are completely reported.

4. The correction factors for natural deaths for non-metro district councils that are urban is the same for all provinces and equal to the weighted average of correction for incompleteness of natural deaths of eight metros.
5. The correction factors for natural deaths for the non-metro councils that are not urban are the same for all provinces.

The detailed steps for calculating the completeness for the metropolitan districts, urban and non-urban non-metropolitan areas and hence for the provinces, given these assumptions, are provided by Dorrington and colleagues[2], together with the resulting estimates of provincial completeness in total and for ages 15+. These correction factors were then applied to the NPR deaths by metro (including non-metro urban and rural), sex, age, and cause (i.e. natural and unnatural) to provide estimates by province and the eight metropolitan districts that are consistent with the national estimate of the true numbers of deaths by age and sex.

It is assumed that the extent of cross-boundary registration is limited and will not materially affect the estimates of provincial death rates. However, it must be noted that the Department of Home Affairs (DHA) office at which the death was registered has been used to identify the location of the death. Because deaths can be registered at any DHA office in the country, the location of the office, even if one assumes that the death was registered at the most convenient office, is not necessarily an indication of the place where the death occurred.

For the weekly reports of deaths, the number of deaths reported to the offices of the DHA for the most recent week needs to be adjusted for the 'incurred but not yet processed' deaths. Even in the absence of closure of offices (due to public holidays, or as a result of contamination during the pandemic), about 20% of natural and 50% of unnatural deaths still remained to be processed for the most recent week being reported on. Within a week, only 1–2% of natural deaths remain to be processed and we calculate a weekly adjustment factor by averaging the increase experienced within a week over the previous 3 weeks. In the case of unnatural deaths, the processing is slower, but within 2 weeks, 5–6% of unnatural deaths remain to be processed. The adjustment factors are reviewed and if necessary, adjusted to account for a public holiday that might increase the proportion yet to be processed. This is done by assessing the previous history of the impact of the holiday being on a particular day of the week – the earlier that the public holiday falls in the week, the less the impact on the number yet to be processed by the end of the week.

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