

The Contribution of Census Data in Maternal Mortality Estimation: a Descriptive Analysis

Background:

Accurate estimation of maternal mortality is critical for informing global health initiatives, especially in areas where limited data availability poses significant challenges. The Maternal Mortality Estimation Inter-Agency Group (MMEIG) leverages a diverse array of empirical data sources for its estimates, including Civil Registration and Vital Statistics (CRVS), specialized studies, population-based surveys like the Demographic and Health Surveys (DHS), and censuses. Utilizing a Bayesian Hierarchical Model (BMat), MMEIG incorporates maternal mortality data alongside various covariates to generate annual country-specific estimates (WHO et al., 2023).

Low-and-Middle-Income countries often lack CRVS data that can be used to measure maternal mortality, and this data gap is filled by population-based surveys and censuses. This analysis focuses on examining how well census-derived estimates of the proportion maternal (PM)—the ratio of maternal deaths among women of reproductive age—align with figures from the DHS and broader MMEIG estimates. Furthermore, it explores the census data's impact on the robustness of MMEIG's maternal mortality estimations by evaluating the effects of its exclusion on the accuracy of mortality predictions. Through this approach, the research aims to underscore the significance of comprehensive data integration in refining maternal mortality assessments, particularly in regions facing acute data shortages.

Methods:

Data: the data used for this study include 45 censuses from 39 countries which are included in the MMEIG maternal mortality database. Additionally, this study uses data from the Demographic and Health Surveys for the countries which have a census included, and the latest MMEIG estimates of the PM (published in 2023).

Analysis: In this study we compare the proportion maternal (PM)—the proportion of deaths to women of reproductive age due to maternal causes—derived from census data against the DHS's PM estimates and the MMEIG estimates. The PM is the measure extracted from censuses for maternal mortality estimation purposes, as it is the measure least affected by over or under-estimation of maternal deaths.

The study further investigates how the removal of census data affects maternal mortality estimation in the countries that have censuses as inputs. This is done by running a one-country model with and without the census as input.

Preliminary results:

Table 1 (TBC) will show a breakdown of the number and type of sources for each region. The table will show that more than half (28) of the census country-years originate from Sub-

Saharan Africa, with an additional ten from Eastern and South-East Asia, highlighting the significant reliance on data from these regions. For the countries that had a census as an input, the median number of data sources per country was four (excluding censuses), and in one country, there were no other sources besides censuses (Solomon Islands).

Table 1: Data types by region from the MMEIG maternal mortality database

| SDG region | Data type | | | | |
|---|-----------|-------------|--------------------------|--------|---------------|
| | CRVS | Specialised | Population-based surveys | census | miscellaneous |
| Central Asia and Southern Asia | 186 | 14 | 44 | 4 | 78 |
| Sub-Saharan Africa | 66 | 1 | 873 | 28 | 26 |
| Northern America and Europe | 1040 | 336 | 0 | 0 | 50 |
| Latin America & the Caribbean | 571 | 232 | 163 | 4 | 81 |
| Western Asia and Northern Africa | 207 | 41 | 46 | 1 | 99 |
| Australia and New Zealand | 26 | 51 | 0 | 0 | 0 |
| Eastern Asia and South-eastern Asia | 158 | 36 | 112 | 10 | 76 |
| Oceania / Oceania excluding Australia and New Zealand | 18 | 0 | 7 | 1 | 13 |

In Figure 1, we show the estimate of the PM from censuses and DHS for each country where there is at least one census included in the MMEIG database. The graph shows that, in general, census estimates are inline with DHS estimates, with few exceptions (Benin, Ethiopia, Guinea Bissau, Liberia, Malawi, and Paraguay)

Figure 1: Comparison of census PM to DHS PM

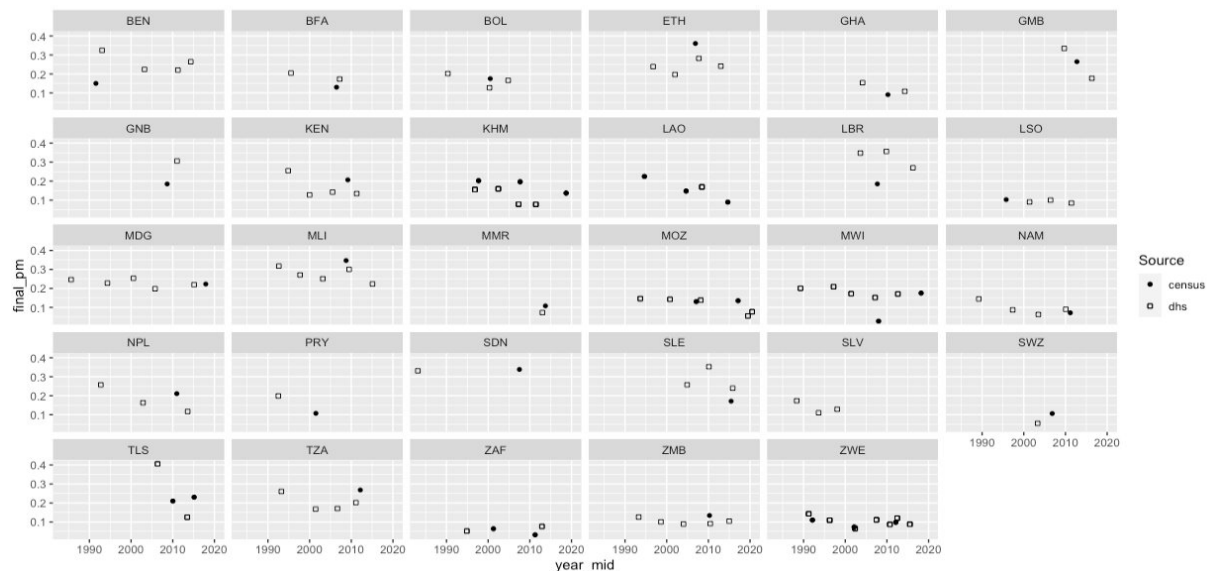
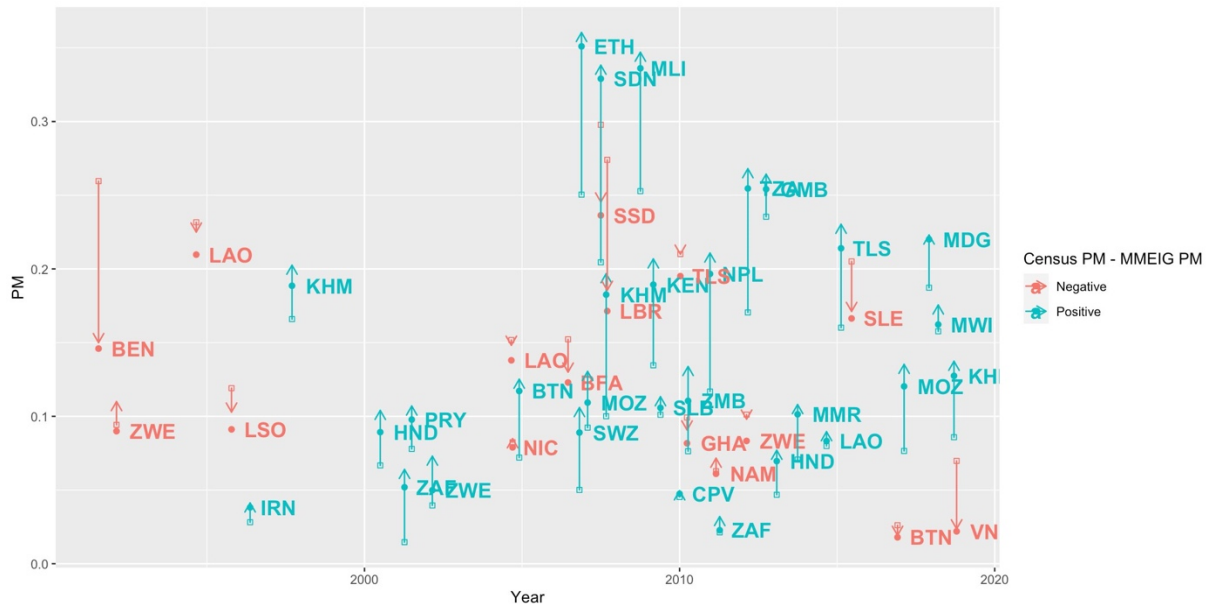


Figure 2 shows the estimate of the PM from censuses and the MMEIG estimate of the PM for the same year and country. Blue arrows indicate a higher census PM than the MMEIG estimate, and red arrow indicate the opposite. The graph shows that in 28 out of 46 censuses, the census PM was higher than the MMEIG estimate. Most notable positive absolute differences in pm are in Sudan 2008 (12 percentage points) and Ethiopia (11

percentage points). To note, Sudan has only one other source - a DHS from 2010 - besides the census.

Most notable negative absolute differences are seen in Benin 1992 (census is 11 points lower) and South Sudan 2008

Figure 2: Comparison of census PM to the MMEIG estimate of the PM for the same year



Figures 3a and 3b show a comparison of the maternal mortality estimates obtained from on-country model runs of of BMat with and without the census data. The graphs show that Overall, removing censuses in one country runs doesn't seem to make a big difference in the PM. The census-included estimate of the PM was slightly lower without the census in Sudan and Solomon Islands, where there are two and no other none census source, respectively. The census-included estimate is slightly higher in South Sudan, where there is only one other data source in the database.

Figure 3a: comparison of one-country run estimates of the PM with and without censuses (countries with PM<=0.14 in 2000)

Comparing one country runs excluding census to the current (2023) estimates
 Countries with PM >=0.14

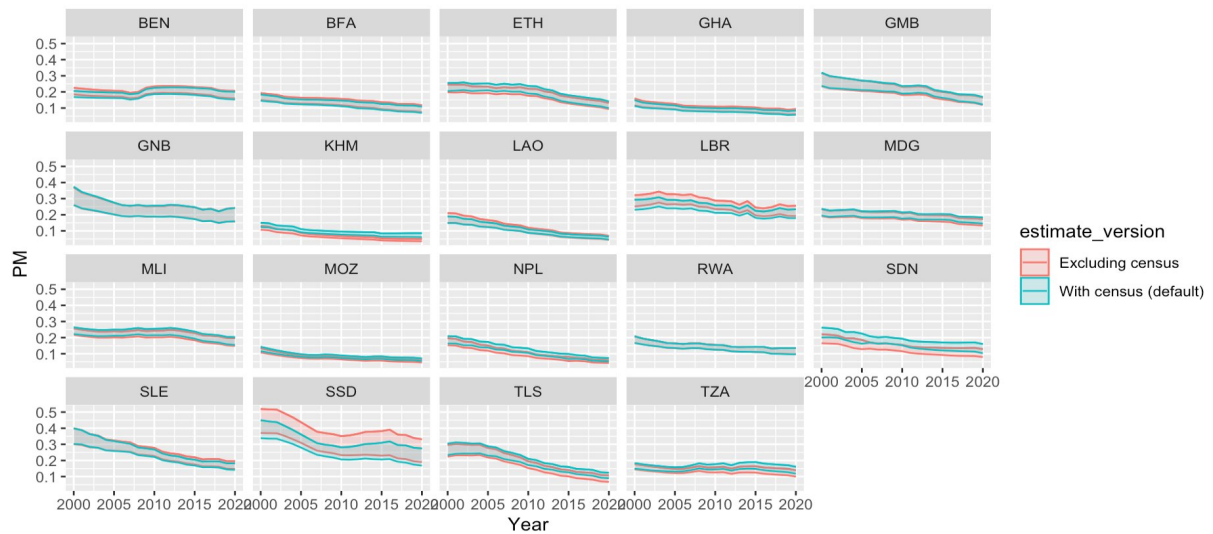
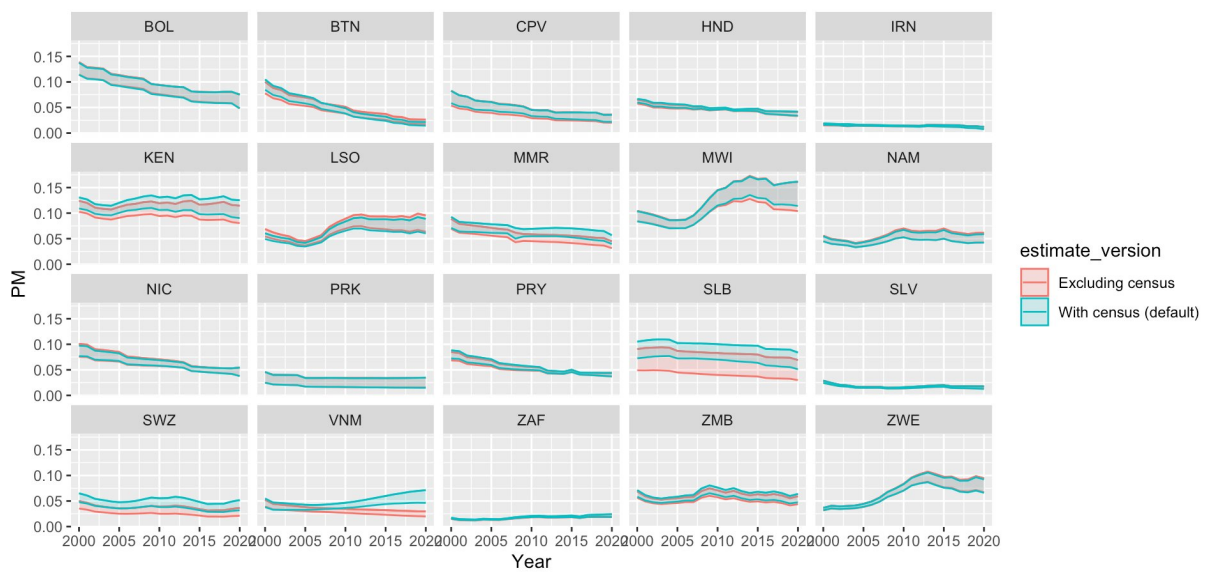


Figure 3a: comparison of one-country run estimates of the PM with and without censuses (countries with PM>0.14 in 2000)

Comparing one country runs excluding census to the current (2023) estimates
 Countries with PM <0.14



Conclusion:

The study underscores the critical role of census data from Sub-Saharan Africa and Asia in maternal mortality estimation, areas marked by data scarcity. The variability in census data alignment with DHS and MMEIG estimates emphasizes the need for a comprehensive approach to data integration. Enhancing the accuracy and reliability of maternal mortality assessments requires a thorough evaluation of all available data, including censuses, to inform effective public health strategies and interventions in data-scarce regions.

References:

WHO, UNICEF, UNFPA, World Bank Group, & UNDESA/Population Division. (2023). *Trends in maternal mortality 2000 to 2020 Estimates by WHO, UNICEF, UNFPA, World Bank Group and UNDESA/Population Division*.