

## Maternal Mortality South Africa 2000-2020

Internationally comparable MMR estimates by the Maternal Mortality Inter-Agency Group (MMEIG): WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division

Table 1: Estimates

Year	MMR <sup>a*†</sup>	PM <sup>b*†</sup>	HIV-related indirect deaths <sup>†</sup>	Live births <sup>c</sup> (Thousands)	Maternal deaths <sup>†</sup>
2000	173 [154, 196]	0.02 [0.02, 0.02]	521	970	1678
2005	221 [200, 245]	0.01 [0.01, 0.02]	947	1074	2370
2010	219 [194, 251]	0.02 [0.02, 0.02]	512	1153	2526
2015	141 [121, 163]	0.02 [0.02, 0.02]	293	1183	1670
2020	127 [99, 154]	0.02 [0.02, 0.03]	182	1195	1516

<sup>a</sup> Maternal mortality ratio (MMR) defined as maternal deaths per 100,000 live births for women of reproductive age (15-49 years).

<sup>b</sup> Proportion maternal (PM) defined as the proportion of all-cause deaths for women of reproductive age (15-49 years) that are due to maternal causes.

<sup>c</sup> UN Population Division, Department of Economic and Social Affairs. World Population Prospects. New York; 2022.

\* The uncertainty intervals (UI) for all estimates refer to the 80% uncertainty intervals (10th and 90th percentiles of the posterior distributions). This was chosen as opposed to the more standard 95% intervals because of the substantial uncertainty inherent in maternal mortality outcomes.

† Figures presented in the table are estimates based on national data, such as surveys or administrative records, or other sources, produced by the international agency when country data for some year(s) is not available, when multiple sources exist, or when there are data quality issues.

Table 2: Estimates

Period	Annual rate reduction*	Percent change in MMR*
2000, 2020	1.47 [0.6, 2.92]	25.46 [11.22, 44.26]
2010, 2020	5.17 [4.02, 8.09]	40.37 [33.11, 55.47]

\* Figures presented in the table are estimates based on national data, such as surveys or administrative records, or other sources, produced by the international agency when country data for some year(s) is not available, when multiple sources exist, or when there are data quality issues.

## Data from civil registration vital statistics system (CRVS)

Table 3: Data from civil registration vital statistics system (CRVS)

Study period <sup>*</sup>	Maternal deaths <sup>a</sup>	Female deaths <sup>b</sup>	CRVS adjustment factor <sup>c†</sup>	Sensitivity <sup>d†</sup>	Specificity <sup>e†</sup>	Completeness <sup>f†</sup>	Usability <sup>g</sup>	Maternal deaths not included <sup>h</sup>
[1996, 1997)	601	34857	1.497124	0.661238	0.999758	67.13727	0.6090490	NA
[1997, 1998)	617	41860	1.493028	0.661238	0.999758	68.43336	0.6382708	NA
[1998, 1999)	620	53505	1.487856	0.661238	0.999758	75.64576	0.6535076	NA
[1999, 2000)	687	64271	1.484642	0.661238	0.999758	79.97984	0.6901612	NA
[2000, 2001)	727	78085	1.481715	0.661238	0.999758	81.01616	0.7126057	NA
[2001, 2002)	846	91577	1.475949	0.661238	0.999758	82.70895	0.7246162	NA
[2002, 2003)	791	110040	1.474713	0.661238	0.999758	84.32184	0.7379063	NA
[2003, 2004)	891	127001	1.473612	0.661238	0.999758	86.51117	0.7480642	NA
[2004, 2005)	1147	137037	1.477371	0.661238	0.999758	87.24359	0.7563663	NA
[2005, 2006)	1243	140890	1.476263	0.661238	0.999758	87.78303	0.7664178	NA
[2006, 2007)	1375	140975	1.475605	0.661238	0.999758	88.31747	0.7722211	NA
[2007, 2008)	1748	134886	1.479647	0.661238	0.999758	89.18554	0.7721012	NA
[2008, 2009)	1781	129216	1.483313	0.661238	0.999758	90.42217	0.7822836	NA
[2009, 2010)	1858	118932	1.485325	0.661238	0.999758	89.93784	0.7848987	NA
[2010, 2011)	1639	108720	1.486872	0.661238	0.999758	90.13505	0.7879539	NA
[2011, 2012)	1246	94320	1.487261	0.661238	0.999758	88.62996	0.7813308	NA
[2012, 2013)	1040	84672	1.485943	0.661238	0.999758	87.66216	0.7774264	NA
[2013, 2014)	941	74713	1.486052	0.661238	0.999758	84.09933	0.7745435	NA
[2014, 2015)	1016	69519	1.486890	0.661238	0.999758	85.67678	0.7772507	NA
[2015, 2016)	936	67062	1.487665	0.661238	0.999758	86.78469	0.7843061	NA
[2016, 2017)	826	66182	1.485534	0.661238	0.999758	90.13674	0.7914757	NA
[2017, 2018)	675	63061	1.488860	0.661238	0.999758	91.70908	0.7982866	NA
[2018, 2019)	552	59752	1.489404	0.661238	0.999758	91.36391	0.8057109	NA

<sup>a</sup> Maternal deaths from CRVS defined as ICD10 codes O00-O95; O98-O99 Pregnancy, childbirth and the puerperium and A34 Obstetrical tetanus. Late maternal deaths (O96) and those deaths due to sequelae of obstetric complications (O97) are excluded for the purposes of international comparison. WHO. International statistical classification of diseases and related health problems. Geneva; 2010.

<sup>b</sup> Female deaths 15-49 from the Civil Registration and Vital Statistics System (CRVS).

<sup>c</sup> CRVS adjustment factor = adjustment factor to account for the difference between CRVS-reported PM and true PM.

<sup>d</sup> Sensitivity = proportion of correctly classified maternal deaths out of all true maternal deaths.

<sup>e</sup> Specificity = proportion of correctly classified non-maternal deaths out of all true non-maternal deaths.

<sup>f</sup> Completeness = percentage of registered deaths of females of reproductive age.

<sup>g</sup> Usability = percentage of deaths that is estimated to be recorded with a well-defined code; completeness proportion\*(1-proportion ill-defined)\*100.

<sup>h</sup> Did not meet inclusion criteria due to: 1) low completeness and usability, or 2) other specialized studies are used. Please see next section of the profile for details.

<sup>\*</sup> Kindly note the interpretation of notation: for a period [a,b) the observation starts on date a and ends before date b; thus a period covering 1st January 2000 through 31st December 2000 is denoted [2000,2001).

<sup>†</sup> Peterson E, Chou D, Moller A-B, Gemmill A, Say L, Alkema L. Estimating maternal mortality using data from national civil registration vital statistics systems: A Bayesian hierarchical bivariate random walk model to estimate sensitivity and specificity of reporting. arXiv:190908578 [stat] [Internet]. 2019 Sep 18 [cited 2021 Aug 11]; Available from: <http://arxiv.org/abs/1909.08578>.

## Excluded data from CRVS

Table 4: Excluded data from CRVS

Study period <sup>*</sup>	Completeness <sup>a</sup>	Usability <sup>b</sup>	Reason for exclusion
[1993, 1994)	59.62638	52.98786	Usability < 60%
[1994, 1995)	67.08303	56.87289	Usability < 60%
[1995, 1996)	68.28986	57.01719	Usability < 60%

<sup>a</sup> Completeness = percentage of registered deaths of females of reproductive age.

<sup>b</sup> Usability = percentage of deaths that is estimated to be recorded with a well-defined code; completeness proportion\*(1-proportion ill-defined)\*100.

\* Kindly note the interpretation of notation: for a period [a,b) the observation starts on date a and ends before date b; thus a period covering 1st January 2000 through 31st December 2000 is denoted [2000,2001).

## Data from other sources

Table 5: Data from other sources

Study period <sup>*</sup>	Source	Source type	Maternal deaths <sup>a</sup>	Preganancy-related deaths <sup>b</sup>	Female deaths, 15-49	Maternal PM <sup>c</sup>	Pregnancy-related PM <sup>d†</sup>	MMR per 100,000 lb <sup>e</sup>	Adjusted MMR per 100,000 lb	F+ <sup>f†</sup>	F- <sup>g†</sup>	U+ <sup>h†</sup>
[1991.39, 1998.39)	DHS 1998	Survey	NA	NA	NA	NA	0.0518175	190.6621	167.0145	NA	NA	NA
[2000.77, 2001.77)	Census	Census	NA	NA	NA	NA	0.0640000	712.7360	577.8649	NA	NA	NA
[2009.42, 2016.42)	DHS 2016	Survey	NA	NA	NA	NA	0.0762546	627.6480	531.3197	NA	NA	NA
[2010.77, 2011.77)	Census	Census	NA	NA	NA	NA	0.0320000	301.2232	214.1466	NA	NA	NA

<sup>a</sup> Maternal deaths defined according to the ICD-10.

<sup>b</sup> Pregnancy-related deaths defined according to ICD-10.

<sup>c</sup> Maternal PM is calculated when deaths are defined as maternal.

<sup>d</sup> Pregnancy-related PM is calculated when reported deaths are defined as pregnancy related deaths.

<sup>e</sup> The MMR in this column is calculated from the PM.

<sup>f</sup> False positive: true non-maternal death which may be incorrectly labeled as a maternal death.

<sup>g</sup> False negative: maternal death which may be incorrectly classified as a non-maternal death.

<sup>h</sup> Maternal deaths not registered in the CRVS.

<sup>\*</sup> Kindly note the interpretation of notation: for a period [a,b) the observation starts on date a and ends before date b; thus a period covering 1st January 2000 through 31st December 2000 is denoted [2000,2001).

<sup>†</sup> Calculated from studies which undertake specialized analyses of routine reporting of maternal deaths.

<sup>‡</sup> Survey data has been adjusted by 1.1 for underreporting and standardized by age when obtained using the direct sisterhood method.

## Data from studies excluded in regression

Table 6: Data from studies excluded in regression

Study period*	Source	Source type	Reason for exclusion
[2006.14, 2007.14)	2007 Community Survey	Miscellaneous	Study not nationally representative

\* Kindly note the interpretation of notation: for a period [a,b) the observation starts on date a and ends before date b; thus a period covering 1st January 2000 through 31st December 2000 is denoted [2000,2001).

## Predictor variables used in the model

Table 7: Predictor variables used in the model

Year	GDP <sup>a*</sup> (Per capita, PPP)	GFR <sup>b</sup> (Per 1000 women ages 15-49)	SBA <sup>c</sup> (%)
2000	11010	80	91
2005	12556	80	93
2010	13725	80	96
2015	13975	80	97
2020	13344	80	98

<sup>a</sup> WHO, MMEIG. Gross domestic product (GDP) per capita measured in purchasing power parity (PPP) equivalent dollars using 2017 as the baseline year were taken from World Bank's World Development Indicators (WDI) database, and in instances supplemented by unofficial estimates derived by MMEIG using growth rates in United Nations GDP data and/or previous MMEIG GDP estimates. Geneva; 2021.

<sup>b</sup> General fertility rate (GFR) from UN Population Division, Department of Economic and Social Affairs. World Population Prospects. New York; 2022.

<sup>c</sup> Skilled Birth Attendant (SBA) from WHO, UNICEF joint SBA database. Geneva; 2022. In some instances, supplemented with unofficial estimates derived by MMEIG. Annual series were estimated by fitting a multilevel time series (AR1) model with region- and country-specific intercepts and slopes.

\* A 5-year moving average was calculated.

## Estimates

(Input data) The following adjustments were applied to maternal deaths depending on the source type:

1. An age-standardization was applied to population based surveys that obtained data from the direct sisterhood method.
2. An upward adjustment of 10% was applied to all input data that were not obtained from CRVS or specialized studies, to account for underreporting.

(Model adjusted data) The following model adjustments were applied to maternal deaths depending on the source type and the definition of reported deaths

1. A model adjustment derived from BMIs was applied to maternal deaths obtained from CRVS.
2. A model adjustment was applied to observations of pregnancy-related deaths to remove accidental/incidental (non-maternal) deaths from the count.

