

# Measuring Maternal Mortality

## Select Topics in International Censuses<sup>1</sup>

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### INTRODUCTION

Maternal mortality is an important global health issue. The third Sustainable Development Goal aims to reduce the global maternal mortality ratio (MMR) to less than 70 per 100,000 live births by 2030 (United Nations, 2015). The World Health Organization (WHO) has set a supplementary national target for countries to reduce the MMR to no greater than 140 per 100,000 live births (World Health Organization, 2015).

The census provides a cost-effective opportunity to measure maternal mortality in countries without a comprehensive vital registration system. Household deaths in the past 12 months is a core topic in the United Nations' (UN) *Principles and Recommendations for Population and Housing Censuses*. Maternal mortality can be measured directly by adding four follow-up questions to the household mortality questions in the census questionnaire. The census is also one of the few ways to obtain subnational measures of maternal mortality. Further, census mortality data can be used to assess the completeness of death registration and maternal deaths.

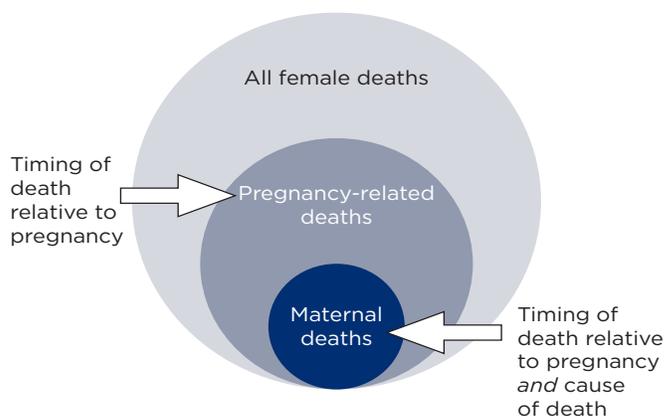
<sup>1</sup> This technical note is one in a series of "Select Topics in International Censuses" exploring matters of interest to the international statistical community. The U.S. Census Bureau helps countries improve their national statistical systems by engaging in capacity building to enhance statistical competencies in sustainable ways.

### INTERNATIONAL CLASSIFICATION OF DISEASES, REVISION 11 DEFINITIONS

**Maternal death:** The death of a woman while pregnant or within 42 days of the termination of pregnancy (irrespective of the duration and the site of the pregnancy) from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.

**Pregnancy-related death:** The death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of cause.

Figure 1.  
**Difference Between Maternal and Pregnancy-Related Death**



Note: The sizes of the circles do not represent actual proportions. Source: U.S. Census Bureau, World Health Organization International Classification of Diseases, Revision 11.

## DEFINITIONS

The International Classification of Diseases (ICD), Revision 11 (World Health Organization, 2022) contains two definitions related to maternal mortality: maternal and pregnancy-related deaths. The box to the right contains the definitions. The difference between maternal and pregnancy-related deaths is that maternal deaths exclude deaths from accidental and incidental causes (i.e., accident, violence, homicide, or suicide), whereas pregnancy-related deaths include deaths from all causes as long as the death occurred during pregnancy or within 42 days of the end of pregnancy. Therefore, maternal deaths are more specific and are a subset of pregnancy-related deaths (Figure 1).

## MATERNAL MORTALITY INDICATORS

Indicators often used to measure maternal mortality are the maternal mortality ratio (MMR or MMRatio), maternal mortality rate (MMRate), proportion of maternal deaths among all deaths of females of reproductive age (PM), and the lifetime risk of maternal death (LTR).

The MMR is the number of maternal deaths per 100,000 live births. Thus, it represents obstetric risk. This is different from the MMRate, which is the number of maternal deaths per 100,000 women of reproductive age (usually ages 15 to 49). MMRate is a cause-specific death rate and represents the risk of maternal death among women of reproductive age. The PM is the proportion of maternal deaths among all deaths of women of reproductive age. The LTR is the probability of a woman dying from maternal causes over the course of her reproductive lifespan (usually 35 years). Refer to Box 1 for more details.

These measures can be used with either maternal or pregnancy-related deaths. When using pregnancy-related deaths, it is important to indicate that the measures are

pregnancy-related rather than maternal. For example, when using pregnancy-related deaths, MMR becomes pregnancy-related mortality ratio.

## RECOMMENDED CENSUS QUESTIONS FOR MEASURING MATERNAL MORTALITY

Both mortality and fertility questions are required to calculate the MMR. The questions needed to measure maternal mortality are included in the Mortality Questions box on the following page. Information on mortality is collected by asking about household deaths in the past 12 months. To reduce misclassification of maternal deaths, it is important to include all three possible timings of deaths in the maternal mortality questions—during pregnancy, while giving birth, and within 6 weeks of the end of a pregnancy or childbirth. It is strongly recommended to ask about the timing of death as three separate questions, rather than a combined question for more accurate recording of the answers.

The two recommended ways to ask about fertility are through questions on: (1) children ever born and children surviving, and (2) last child born alive. The UN does not recommend asking whether there were any births in the past 12 months to obtain current fertility estimates because it is subject to more errors and omission than the other two approaches. Further information on fertility questions in a census can be found in a separate Select Topics in International Censuses brief titled “Measuring Fertility From a Census.”

Children ever born and children surviving questions are asked in a sequence. Asking this sequence of questions improves recall and reduces underreporting. If a question about the total number of sons and daughters ever born alive is asked, the enumerator can check the responses for any inconsistencies and resolve them during the interview.

By asking about the last child born alive, the number of women who have given live birth in the 12-month period preceding the census can be estimated. This number is a close approximation to the number of live births in the 12-month period since the chances of a woman having more than one live birth in a year is small.

To obtain information about fertility, it is recommended that the fertility questions are asked directly to the woman concerned. She is more likely to have the most accurate information about her own fertility than any other household member.

### Box 1.

$$\text{MMR} = \frac{\text{Number of maternal deaths}}{\text{Number of live births}} * 100,000$$

$$\text{MMRate} = \frac{\text{Number of maternal deaths}}{\text{Number of women aged 15-49}} * 1,000$$

$$\text{PM} = \frac{\text{Number of maternal deaths}}{\text{Number of deaths among women aged 15-49}}$$

$$\text{LTR} = \frac{T_{15} - T_{50}}{I_{15}} * \text{MMRate}$$

Where  $T_{15}$  is the life table person-years lived above age 15,  $T_{50}$  is the life table person-years lived above age 50, and  $I_{15}$  is survivors to age 15.

**Box 2.****MORTALITY QUESTIONS**

1. Has any usual member of this household died in the last 12 months?
2. If yes, record the following information about each deceased person:

Name	Sex	Age at death (in completed years)	Was the death due to an accident, violence, homicide, or suicide?*	Maternal mortality questions: If the deceased was female aged 15-49 at the time of death, was she:		
				Pregnant?	Giving birth?	Within 6 weeks of the end of a pregnancy or childbirth?
			Yes No	Yes No	Yes No	Yes No
			Yes No	Yes No	Yes No	Yes No
			Yes No	Yes No	Yes No	Yes No
			Yes No	Yes No	Yes No	Yes No
			Yes No	Yes No	Yes No	Yes No

\* The question on death due to an accident, violence, homicide, or suicide is necessary to count maternal deaths, as those causes need to be removed from the calculation. If this question is not included, only pregnancy-related deaths can be measured.

**FERTILITY QUESTIONS****Children ever born and children surviving**

1. How many sons have you ever given birth to who:
  - a. Are still alive and live with you?
  - b. Are still alive but live elsewhere?
  - c. Were born alive but later died?
2. How many daughters have you ever given birth to who:
  - a. Are still alive and live with you?
  - b. Are still alive but live elsewhere?
  - c. Were born alive but later died?

**Last child born alive**

1. In what month and year did you have your most recent live birth?

## ISSUES TO CONSIDER IN QUESTIONNAIRE DESIGN

Issues to Consider	Description
Placement of mortality questions in the questionnaire	Keep the household deaths questions in a self-contained box in a prominent position of the census questionnaire. Avoid using a separate sheet.
Recall period for household deaths	Length of the recall period is generally 12 months, but can be changed to anchor it to a well-known day (e.g., end of Ramadan). Including the dates of the recall period in the question may improve data quality. For small populations, it can also be extended to 24 months. If using a 24-month recall period, a question on the second-most recent births should be added in the fertility section.
Names of the deceased	Asking names of the deceased generally improves recall.
Using “years”	Avoid the use of “years.” Wording like “in the last year” can be interpreted as the last calendar year instead of the last 12 months.
Age at death vs. dates of birth and death	Age at death can be replaced with the date of birth and date of death, if dates are well known and well reported in a population. Dates of deaths may also be used to verify that the deaths occurred during the recall period.
Reproductive age	In populations where childbearing begins at younger ages, the maternal mortality questions can be asked of females who died aged 12 to 49 instead of 15 to 49.
Maternal mortality questions	Asking three questions to identify the timing of death for a woman aged 15 to 49 is recommended. It is not recommended to combine the questions into a single question.
Postpartum period	The International Classification of Diseases, Revision 11 (ICD-11) defines postpartum period as 42 days. However, 6 weeks can be used for simplicity.
Cause of death in census questionnaire	<ul style="list-style-type: none"> <li>• Attempting to collect maternal deaths as part of a list of causes of deaths will likely not capture all maternal deaths (as defined by ICD-11). Rather, the United Nations recommends asking the set of questions listed in the Mortality Questions text box on p. 3.</li> <li>• It is not recommended that complete cause of death information be collected in the census. Rather, it is better to conduct a follow-up verbal autopsy (for a sample of household deaths).</li> </ul>

## COMMON DATA COLLECTION ERRORS

Common Sources of Errors	Description	Recommendations
Skipping questions about deaths	Death is a sensitive topic. The enumerators may avoid asking questions about deaths because they are uncomfortable asking the questions.	<ul style="list-style-type: none"> <li>• Make sure the household deaths questions appear in a prominent position of the questionnaire. Avoid using a separate sheet.</li> <li>• Train the enumerators on asking the questions about deaths in a sensitive way. Emphasize the importance of asking these questions in every household.</li> <li>• Supervisors should check the deaths questions to make sure they are not left blank.</li> </ul>
Use of incorrect reference period for deaths	<ul style="list-style-type: none"> <li>• Generally, the question about deaths asks about the 12-month period before the census date. However, the respondent may list all deaths that have ever occurred in the household.</li> <li>• The respondent may be unclear when the 12-month period began and, therefore, may omit some deaths.</li> </ul>	<ul style="list-style-type: none"> <li>• Train the enumerators to clearly specify the correct reference period. It may be helpful to define the reference period using a festive or historic date (e.g., the end of Ramadan, independence day).</li> <li>• If the number of deaths in a household within a 12-month period seems unusually high, probe to see if the deaths occurred within the reference period.</li> </ul>
Using inconsistent definition of household members	Although the question is about household deaths, the respondent may include deaths of family members not usually living in the household, occasional visitors, or other extended family.	Train the enumerators to include only deaths of usual household members. Do not include deaths of occasional visitors or extended family.
Incorrect recording of age at death	<ul style="list-style-type: none"> <li>• The respondent may not know the exact age at which the household member died.</li> <li>• The enumerators may not record the age in completed years.</li> </ul>	<ul style="list-style-type: none"> <li>• Train the enumerators so that they sufficiently probe the age at death if unknown. A historic calendar of events is often useful for probing.</li> <li>• Make sure the enumerators record the age in completed years.</li> <li>• Check for inconsistencies.</li> </ul>
Recording the age of the child instead of the age of the mother at the time of her death	The enumerators may record the age of the newborn child rather than the age of the deceased.	<ul style="list-style-type: none"> <li>• Emphasize during training that age should be the age of the deceased woman, not the age of the newborn.</li> <li>• Check for inconsistencies (especially for maternal mortality with recorded age of 0).</li> </ul>
Skipping the maternal mortality questions	<ul style="list-style-type: none"> <li>• Maternal deaths are often rare events. The enumerators may forget to ask the questions or assume the responses are “no.”</li> <li>• If a respondent offers a cause of death without prompting, the enumerator may skip the maternal mortality questions.</li> <li>• Example: A respondent says his wife (aged 30) died of cancer. The enumerator assumes the cause was nonmaternal and does not ask the maternal mortality questions, but the woman had given birth 4 weeks prior to her death. In this case, the death is maternal, but would be misclassified as nonmaternal.</li> </ul>	<ul style="list-style-type: none"> <li>• Train the enumerators to always ask the maternal mortality questions if a woman of reproductive age had died in the household.</li> <li>• Supervise fieldwork to make sure that the enumerators are asking these questions.</li> </ul>

Table continues on next page.

## COMMON DATA COLLECTION ERRORS—Con.

Common Sources of Errors	Description	Recommendations
Omitting pregnancies that did not result in a live birth when asking about the postpartum period	When asking whether the woman died within 42 days of the end of pregnancy, the enumerators and respondents may consider only pregnancies that resulted in a birth. Postpartum period refers to the period 42 days after the end of the pregnancy regardless of the outcome of the pregnancy. Deaths within 6 weeks of a miscarriage, abortion, or stillbirth also should be recorded as maternal.	During training, emphasize that end of pregnancy includes miscarriage, abortion, stillbirths, and live births.
Omitting short pregnancies when asking about the postpartum period	<ul style="list-style-type: none"> <li>The enumerators and respondents may not consider short pregnancies as pregnancies.</li> <li>Postpartum period is 42 days following the end of the pregnancy regardless of the duration of the pregnancy.</li> <li>Example: If a woman was pregnant for 5 weeks before she had a miscarriage, the period 6 weeks after the miscarriage is the postpartum period.</li> </ul>	Emphasize in the training that a pregnancy of any duration is a pregnancy.
Respondent unable to complete questionnaire due to anger or grief expressed towards the enumerator	Deaths are tragic events and asking about deaths may evoke strong negative reactions from the respondents. As a result, the respondent may not be able (or refuse) to complete the questionnaire.	<ul style="list-style-type: none"> <li>Prepare the enumerators for these situations during training so that they can maintain good rapport with the respondents and can complete the interview.</li> <li>Pretest the questions to see how respondents react to the questions. If the questions cause strong negative reactions, consider moving the questions to the end of the questionnaire.</li> </ul>

## DATA TABULATION

The WHO guidance (2013) recommends including the following content in census-based publications on maternal mortality.

In the basic volume of census results:

- Data on population by age and sex.
- Data on the number of deaths over the reference period by age and sex.
- Data on the number of deaths among women aged 15–49 (or 12–49) who died during pregnancy, delivery, or within 6 weeks after the end of pregnancy by accidental or incidental cause of death.
- Data on the number of births over the same reference period by age of the mother.
- Data on children ever born and children surviving (or dead) by age of mother.

In the analytical volume:

- Maternal or pregnancy-related mortality indicators by age, region, and household socioeconomic status, with adjustments if necessary.

It is very important to clearly state whether the reported indicators are maternal or pregnancy-related. Maternal mortality indicators must exclude deaths from accidental and incidental causes. Otherwise, they are pregnancy-related indicators.

## DATA EVALUATION AND ADJUSTMENT

Mortality and fertility data collected from a census should undergo rigorous quality assessment. Some data errors can be corrected through editing. The UN “Handbook on Population and Housing Census Editing, Rev. 2” (2021) and the WHO guidance (2013) describe the process of editing in detail.

Further, in population censuses, failure to report household deaths and births can be nontrivial. Therefore, data quality should be evaluated carefully and adjustments need to be made before producing final maternal mortality estimates. The WHO guidance (2013) describes the different ways in which the data can be evaluated and adjusted. CensusPRM is an Excel spreadsheet that can guide analysts in adjusting census-based births and deaths (United Nations Maternal Mortality Estimation Interagency Working Group Census Technical Working Group, 2017).

## REFERENCES

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