

Spotlight

High risk of maternal death in Southern Tanzania

Key points

- Maternal mortality in Southern Tanzania was 712 deaths per 100,000 live births - more than 50% higher than the national average.
- The most common causes of maternal death were severe bleeding, malaria, anaemia, hypertensive complications, sepsis and AIDS/TB.
- The risk of dying was highest in the poorest households and in households where the household head had no secondary education. However, the risk of death remained high even among richer and better-educated households.
- Deaths were common even among women living close to a hospital, and in settings where most women gave birth in a health facility. But among women who lived far from a hospital the chance of death was a third greater than among those living nearby.

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Introduction

Reduction of maternal deaths¹ is one of the main goals of the Tanzanian Poverty Reduction Strategy and the health sector reform program, but progress has been slow. According to the 1996, 2004 and 2010 Demographic and Health Surveys (DHS), the maternal mortality ratios (MMR) or maternal deaths per 100,000 live births were 529, 578, and 454 per 100,000 live births respectively for the 10-year period prior to the surveys [1, 2].

Maternal mortality levels by age, education or wealth often reveal major inequities, highlighting the need to reach the most vulnerable. But such information is not available from national surveys because the DHS applies the “sisterhood method”, an indirect technique used to estimate maternal mortality (see box). We assessed maternal mortality in a large household census including all 225,000 households in five districts, giving timely

1. Maternal deaths include all deaths in pregnancy, childbirth and 42 days post-partum regardless of the reason of deaths. But co-incident deaths such as these due to accidents are excluded.

mortality data by relative wealth, educational levels and distance to the nearest health facility [4].

Box: Methods to estimate maternal mortality

The sisterhood method [3], which is the method used in DHS surveys to assess maternal mortality, asks women about any sisters born to the same mother and whether the sisters are still alive or died, and if so when and whether the sister died in pregnancy, childbirth or the postpartum period. Based on this information the proportion of deaths among women of reproductive age related to maternal causes are calculated. Together with information on the number of live births per women of reproductive age (known as the general fertility rate) the MMR can be calculated. The calculation is done for a time period of seven to ten years prior to the survey. As sisters are asked about deaths of sisters no information is available of wealth or education or any other characteristics of the household, nor the cause of death.

In contrast, large household surveys or censuses include information on deaths and births in each household, and this can be linked to the relative poverty of the household, education level, and the geographic location. However, this method needs a larger sample than the sisterhood method used in the DHS.

Methods

We used information collected during a 2007 household survey of all households in five districts of Tandahimba and Newala in Mtwara Region and Lindi Rural, Ruangwa and Nachingwea in Lindi Region [5, 6]. A questionnaire recorded all household members and information on age and education. Also, household assets, including possession of a bednet, bicycle or phone, the type of roofing, cooking power and others, were recorded as proxy indicators of household socioeconomic status. In addition, the geographic location was recorded and used to calculate distance to the nearest hospital.

Live births in the three years before the survey were recorded through interviews with women of reproductive age (13–49 years).

2. It is “pregnancy-related mortality” not “maternal mortality” that is assessed when asking about deaths in pregnancy and childbirth at household level. To calculate the true maternal mortality ratio, deaths due to coincidental causes such as accidents should be excluded. The “coincidental” deaths are generally a minor fraction, and hence we use the terms “maternal mortality” and “pregnancy-related mortality” interchangeably.

The head of household was asked whether any household member had died since 2004 and for women who had died, whether the death occurred during pregnancy, childbirth or within the post-partum period. Bereaved relatives of women whose deaths were reported to be pregnancy-related were interviewed to try to establish likely causes of death, using a 'verbal autopsy'.

Two physicians reviewed each of these interviews, and independently assigned a likely cause of death. If concordant, the cause of death was taken as the final probable cause of death. If the two physicians could not agree on a cause of death, a third physician was asked to give an independent opinion. If all three physicians could not agree, the cause of death was recorded as "no agreement".

For analysis we calculated mortality ratios by dividing the reported maternal deaths by the number of live births reported. Ten household assets and housing condition indicators were combined into an index of relative wealth and used to allocate each household to one of five equal-sized groups of relative poverty.

Distance to a hospital was estimated using the straight-line distance from each individual household to the nearest of the six hospitals in the five districts and a further two which were located just outside the district borders and frequently serve the people in the study districts.

Risk of death by district, poverty, education and age

Maternal mortality in Lindi Rural, Ruangwa, Nachingwea, Newala and Tandahimba in southern Tanzania was high at 712 deaths per 100,000 live births (95% CI 652–777) during the three-year period from June 2005 to May 2007. Maternal mortality was highest in Lindi Rural district (959 deaths per 100,000 live births), and lowest in Tandahimba district (573 deaths per 100,000 live births). (Table 1)

Maternal mortality was 796 per 100,000 in the poorest wealth group and 581 per 100,000 live births in the highest wealth group (see Table 1 and Figure 1). Mortality was only around 27% lower in the richest compared to the poorest wealth quintile (MMR of 581 compared to 796). This was surprising against the background that 57% of women in the highest wealth group delivered in a health facility and 6% delivered by Caesarean section.

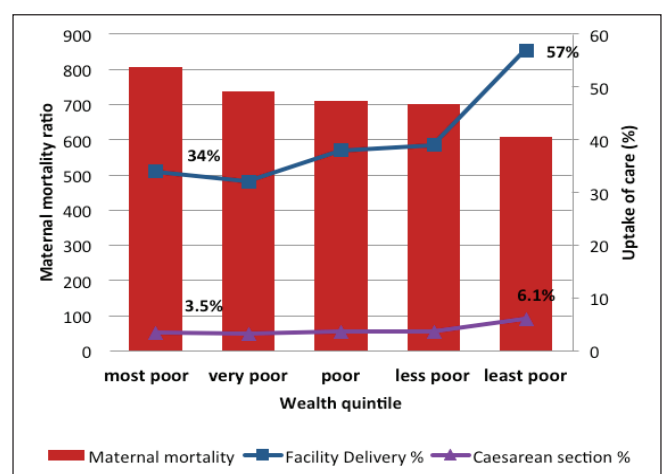
In comparison, only 34% of women in the lowest wealth group delivered in a health facility and 3.5% by Caesarean section. Mortality was almost twice as high in women if the household head had no education compared to those who had completed secondary school.

Table 1: Maternal mortality by district, educational level and relative poverty

	Number of deaths (N= 507)	MMR (95%CI) (71,198 live births)
District		
		p<0.001 [#]
Lindi Rural	170	959 (821-1113)
Nachingwea	98	705 (573-859)
Ruangwa	63	634 (488-811)
Newala	83	620 (494-768)
Tandahimba	93	573 (462-701)
Wealth quintiles		
		p=0.094 [^]
Most poor	87	796 (638-981)
Very poor	90	723 (582-888)
Poor	101	692 (564-841)
Less poor	103	682 (557-827)
Least poor	89	581 (467-715)
Education of head of household		
		P<0.001 [^]
No education	162	916 (781-1068)
Some primary	130	1021 (854-1211)
Completed primary	201	529 (458-607)
Secondary or higher	3	514 (106-1494)
Overall	507	712 (652-777)

#p-values are from the Chi-squared test and the ^score test for trend (wealth quintiles, education)

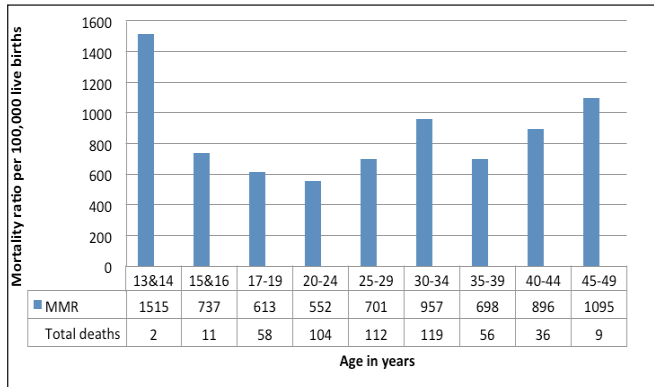
Figure 1: Maternal mortality and uptake of care by wealth quintiles (p-value for trend p=0.094 for the effect of wealth on maternal mortality)



Women aged 17 to 25 years were at the lowest risk of maternal death compared to those older or younger. Very young women -- those aged 13 or 14 years -- had very high risk of dying. Women in their thirties and forties were more likely to die than women in their twenties. It

is important to note 18% of births are to mothers aged 35 and above which is why many maternal deaths occur among older women (Figure 2).

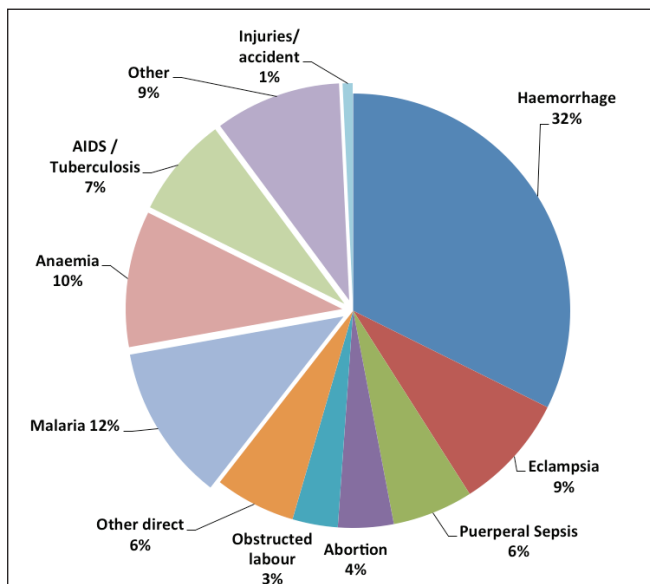
Figure 2: Maternal mortality by age of the mother (p-value for differences between category <0.001)



Causes of maternal death

The three most common obstetric causes of death were severe bleeding (32%), eclampsia (hypertensive disorders; 9%) and puerperal sepsis (6%) (Figure 3). Abortion related complications were mentioned in 4% of deaths, but since abortion is a taboo subject and induced abortion is illegal in Tanzania, this is likely to be underreported.

Figure 3: Cause of maternal death for 267 deaths where physicians agreed on the cause. Indirect causes are separated out and shown in pastel colors



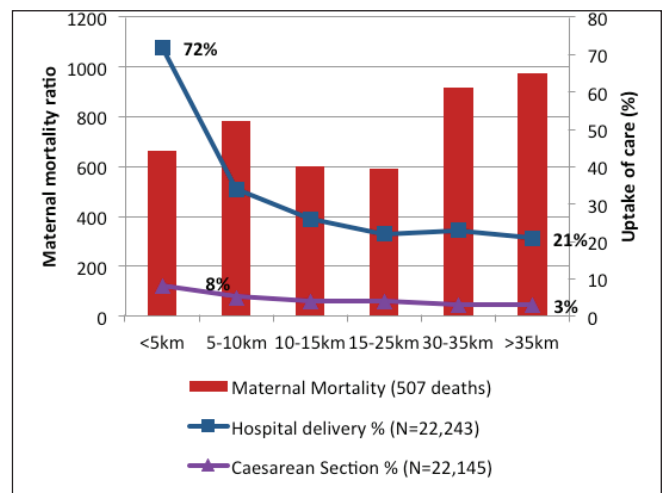
One-third of the deaths were due to diseases which might get worse during pregnancy and childbirth, known as “indirect causes”, such as malaria (12%), anemia (10%) or HIV (8%). These results should be viewed with some caution, because the ‘verbal autopsy’ interviews with bereaved relatives are likely to be more prone to error for deaths due to infectious diseases than for severe bleeding. Still, a study using clinical autopsy in a tertiary hospital

in Mozambique also reported a broadly comparable distribution of deaths due to infection [7].

Child birth care in hospitals and risk of maternal death

The study area has a relatively good network of six hospitals, with a further two just outside the district borders. A total of 76% of births were to women living within 25 km of a hospital. Within 25 km, mortality was fairly constant at about 600–700 deaths per 100,000 live births. Beyond 25km from a hospital, levels increased to 900 per 100,000 (see Figure 4). Mortality was also high within 5km of a hospital, despite 72% of women living within 5km giving birth in a hospital and 8% delivered by Caesarean section.

Figure 4: Maternal mortality and uptake of delivery care by distance to a hospital (p-value for trend 0.043 of the effect of distance on maternal mortality)



Conclusions and recommendations

Maternal mortality was higher than the national average of 454 deaths per 100,000 live births in this disadvantaged area. The main causes of death were haemorrhage, malaria, anemia, eclampsia, puerperal sepsis and AIDS/tuberculosis.

Deaths were common even among women close to a hospital, and in settings where most women gave birth in a health facility. But among women who lived far from a hospital the chance of death was a third greater than those living nearby. The quality of care in hospitals may be an important factor determining women’s survival and should be prioritized.

Many deaths in pregnancy and childbirth were due to infections such as malaria, HIV or tuberculosis: an integrated approach is needed to manage women with these diseases in pregnancy and childbirth.

The full analysis is available <http://researchonline.lshtm.ac.uk/1012993/>

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Literature

1. National Bureau of Statistics (NBS) Tanzania and ORC Macro, *Tanzanian Demographic and Health Survey, 2004 - 2005*, Dar es Salaam, Tanzania.
2. National Bureau of Statistics (NBS) Tanzania and ICF Macro, *Tanzania Demographic and Health Survey, 2011*, NBS and ICF Macro, Dar es Salaam, Tanzania.
3. WHO and UNICEF, *The Sisterhood Method for Estimating Maternal Mortality: Guidance Notes for Potential Users*, 1997, Geneva: Division of Reproductive Health, WHO.
4. Stanton, C., et al., *Every Death Counts: Measurement of Maternal Mortality via the Census*. Bulletin of the World Health Organisation, 2001. **79**(7): p. 657-664.
5. Penfold, S., et al., *A Large Cross-Sectional Community-Based Study of Newborn Care Practices in Southern Tanzania*. PLoS ONE, 2010. **5**(12): p. e15593.
6. Schellenberg, J., et al., *Cluster-Randomized Study of Intermittent Preventive Treatment for Malaria in infants (IPTi) in Southern Tanzania: Evaluation of Impact on Survival*. Malaria Journal, 2011. **10**(1): p. 387.
7. Menéndez, C., et al., *An Autopsy Study of Maternal Mortality in Mozambique: The Contribution of Infectious Diseases*. PLoS Med, 2008. **5**(2): p. e44.