A global comparison of the Lifetime Risk of Maternal Near Miss morbidity

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Abstract

Background

The lifetime risk of maternal near miss (LTR-MNM) is a novel measure which quantifies the probability that a 15-year-old girl will experience a life-threatening maternal complication during her reproductive lifetime, accounting for survival from age 15-49 and fertility levels. Morbidity of this severity has long- term sequalae for women's physical, psychological, and sexual wellbeing. Global comparisons of the LTR-MNM are needed to better understand the burden of severe maternal morbidity across the reproductive life course.

Methods

We calculate the LTR-MNM for five countries with population-based, nationally- or regionally representative data on MNM morbidity (Namibia, South Africa, Suriname, Brazil, and China), using World Population Prospects data on fertility and mortality. With the lifetime risk of maternal death (LTR-MD), we also estimate the lifetime risk of severe maternal outcome (LTR-SMO = LTR-MNM + LTR-MD) to calculate the relative contribution of MNM morbidity to maternal ill-health for countries at different stages of the obstetric transition.

Preliminary results

We estimate that the LTR-MNM ranges from a 1 in 145 risk in China (2015 estimate) to 1 in 35 in Namibia (2019 estimate). Similarly, the LTR-SMO ranges from 1 in 137 risk of maternal death or MNM morbidity in China, to a 1 in 28 risk in Namibia. The relative contribution of MNM to the LTR-SMO for China and Namibia are 94% and 79%, respectively – corresponding to Namibia's earlier position in the obstetric transition.

Conclusions

Our results demonstrate the utility of the LTR-MNM to compare the burden of MNM morbidity across countries and the need for nationally-representative, population-based estimates of MNM.

Background

The lifetime risk of maternal death (LTR-MD) is a widely used summary measure of maternal health. As most commonly measured, this denotes the probability of that 15-year-old girl will die from a maternal cause in her reproductive lifetime, accounting for other competing causes of mortality (1). Its intuitive appeal means it is used to compare differences between countries and changes over time in WHO and UN agency joint maternal mortality estimates (2). However, for every woman who dies from a maternal cause, as many as 20 women may experience a life-threatening "maternal near miss" complication (3), defined as a *"woman who nearly died but survived a complication that occurred during pregnancy, childbirth, or within 42 days of termination of pregnancy"* (4). Cases are identified on the basis of clinical, laboratory, and management-based criteria of organ dysfunction (4).

Substantial reductions in maternal mortality have occurred in the last two decades (2) as countries advance through the obstetric transition – the secular shift from high to low maternal mortality and direct obstetric to indirect causes of maternal death (5). Expansions in access to and improvements in the quality of emergency obstetric care means that many more women who experience a life-threatening complication now survive pregnancy and the immediate 42 day postpartum period (5). Nonetheless, experiencing a complication of this severity may have significant sequelae far beyond 42 days postpartum, including for women's long-term survival, physical and mental health outcomes, and socio-economic wellbeing (3,6–11).

Analogous to the concept of LTR-MD, we have proposed a new indicator – the lifetime risk of maternal near miss (LTR-MNM) – to measure the probability a 15-year-old girl will experience a maternal near miss during her reproductive (12). This novel metric is required because existing measures of maternal near miss prevalence in relation to either the number of live births (MNMRatio) or to the female population of reproductive age (MNMRate) do not quantify the cumulative risk of maternal morbidity over a woman's reproductive life from repeated exposures to pregnancy and childbirth. Nor do they account for survival from ages 15-49 (i.e., all-cause mortality levels, including maternal causes). As a function of the maternal near miss ratio, fertility, and mortality levels, the LTR-MNM addresses these deficits.

New research is needed to compare the LTR-MNM across countries and over time, to better understand global inequities in the burden of MNM morbidity throughout the female reproductive life course. This present study extends our novel development of the LTR-MNM indicator and demonstrates its calculation across multiple countries with available data.

Data and methods

For international comparisons of the LTR-MNM, we have selected countries with nationally- or regionally representative data on MNM. This is required because fertility and mortality data from World Population Prospects is aggregated at the national level. Second, we estimate the LTR-MNM for countries with population-based estimates of the MNMRatio, or with facility-based data where institutional delivery rates are close to 100%. While MNM will occur in facilities, population-based estimates of live births are required to avoid overestimating the MNMRatio. Accordingly, using available data on the MNMRatio, we estimate the LTR-MNM in Namibia (13), South Africa (14–16), Suriname (17), Brazil (18), and China (19).

To estimate the LTR-MNM, we use the formula described in first our paper, currently under review at the International Journal of Epidemiology (12). Where age-disaggregated data on the MNMRatio are available, we use equation 1 as follows:

$$LTR_{MNM} = \sum_{x}^{x+n} {}_nMNMRatio_x \cdot {}_nf_x \cdot \frac{{}_nL_x}{l_{15}} \quad (1)$$

Where ${}_nf_x$ are age-specific fertility rates, and $\frac{{}_nL_x}{l_{15}}$ is the expected number of years lived in the age interval. In cases where age-disaggregated data are not available, we use the following approximation:

$$LTR_{MNM} = {}_{35}MNMRatio_{15} \cdot NRR \cdot 2.01 \cdot \frac{l_0}{l_{15}} \quad (2)$$

Where the NRR is the net reproduction rate and 2.01 is an adjustment factor based on the sex ratio at birth (since the NRR is female births only). Finally, we estimate the LTR-SMO using equation 3 as follows:

$$LTR_{SMO} = LTR_{MD} + LTR_{MNM} \quad (3)$$

Preliminary Results

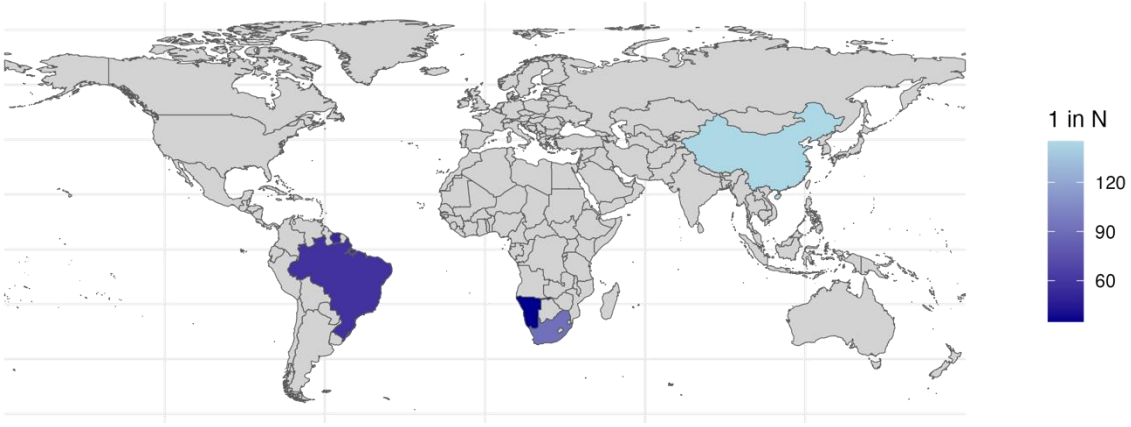
Please note: the results presented here are preliminary. We present the LTR-MNM for five countries as illustrative examples. We will extend these results to additional countries and include high-income countries before EPC 2024.

Table 1 presents the LTR-MNM, compared to the LTR-MD, the LTR-SMO, and the relative contribution of MNM morbidity to the overall lifetime burden of severe maternal outcome for five selected countries. The LTR-MNM is presented in Figure 1 below. These results for low- and middle-income countries show vast disparity in the lifetime risk – with a 15-year-old girl in Namibia experiencing a fourfold higher lifetime risk of MNM morbidity than in China.

Table 1. Lifetime risk of MNM, maternal death, and severe maternal outcome

Country (year)	LTR-MNM	LTR-MD	LTR-SMO	Contribution of MNM to LTR-SMO
Namibia (2019)	1 in 35	1 in 130	1 in 28	79%
South Africa (2014)	1 in 64	1 in 292	1 in 53	82%
Suriname (2018)	1 in 53	1 in 430	1 in 47	89%
Brazil (2010)	1 in 58	1 in 780	1 in 54	93%
China (2015)	1 in 145	1 in 2364	1 in 137	94%

Figure 1. Lifetime risk of maternal near miss for select countries.



Research contribution

Our preliminary results show substantial global variation in the lifetime risk of MNM morbidity. MNM have long term sequalae for women, their families, communities, and health systems. Hence, it is important to understand differences in the burden of MNM morbidity across the female reproductive life course between countries and over time. This work is the first of its kind to estimate the LTR-MNM for multiple countries and builds on our first paper that demonstrates the calculation of LTR-MNM (under review at IJE).

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