Lifetime risk of maternal mortality in Zambia using census data

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EXTENDED ABSTRACT

Background

Combinations of factors influence the risk of a woman dying from a pregnancy-related cause during the course of her reproductive life. Most deaths occur around labour and the immediate period after. Haemorrhage, sepsis, obstructed labour and complications of abortion are among the major direct causes, while HIV/AIDS is a major indirect cause of pregnancy-related deaths (Ronsmans, Graham, & Lancet Maternal Survival Series steering, 2006). Understanding the level of risk in different subgroups is critical to providing focused interventions aimed at averting the deaths. However, the focus has been on the measurement of the maternal mortality ratio at the expense of other equally useful indicators such as estimates of lifetime risk (Abouzahr, 2011).

There are two measurements of lifetime risk used: *adult lifetime risk of maternal death,* which is the probability that a 15-year-old woman will die eventually of maternal causes (WHO., 2012); and the *lifetime risk of maternal death,* which considers the probability of female infants growing up to adulthood and eventually dying of maternal causes (i.e. cumulative loss of life due to maternal death over the female life course). The latter takes into account competing causes of death in the estimation of risk and provides a summary measure of the impact of maternal mortality (Wilmoth, 2009).

Methods

Using pregnancy-related deaths captured in the Zambia 2010 Census, we applied estimation techniques put forward by Wilmoth (2009). We computed the three estimates as follows;

1. Lifetime risk of dying of pregnancy-related causes (in the absence of competing causes) among a cohort of infant females (LR_1)

$$LR_1 = \sum_x MMRatio_x \times f_x = \sum_x MMRate_x$$

2. Lifetime risk of dying of pregnancy-related causes (with competing causes considered) among a cohort of infant females (LR_2)

$$LR_2 = \sum_x MMRatio_x \times f_x \times \frac{L_x}{l_0} = \sum_x MMRate_x \times \frac{L_x}{l_0}$$

3. Lifetime risk of dying of pregnancy-related causes (with competing causes considered) among a cohort of adolescents aged 15 years (LR_3)

$$LR_3 = \sum_x MMRatio_x \times f_x \times \frac{L_x}{l_{15}} = \sum_x MMRate_x \times \frac{L_x}{l_{15}}$$

Note: In equation 2, l_0 referes to the hypothetical female birth birth cohort, while l_{15} in equation 2 referes to the survivors of the female birth cohort to exact age 15. In equations 2 & 3 the L_x referes to the total number of woman-years spent exposed to the risk of death by survivors to exact age x.

Estimation of life table parameters

Deaths of females 12 months prior to the census were captured together with pregnancy-related deaths. These were evaluated for completeness and adjusted using the general growth balance (GGB) method (Hill et al., 2009). Age adjusted female life tables were generated for rural and urban areas using LTPOPDEPTH and LTMXQXAD spreadsheets (US Census Bureau, 1994). Survival ratios were then applied to age-specific pregnancy-related mortality rates.

Results

In Table 1, the summary measure of lifetime risk LR_1 obtained by summing up the age specific risk is provided for both rural and urban areas. In the absence of competing causes, one in every 23 girls born in Zambia and surviving to adolescence will die from a pregnancy-related cause during her reproductive life course (Table 1). The risk of a pregnancy-related death is higher for girls born in rural areas (one in every 20) than urban areas (one in every 31).

Table 1: Lifetime risk of dying of maternal causes (when competing causes are eliminated from the calculation) among a cohort of infant females (LR_1)

	Total		Rural		Urban	
Age Group	MMRate	LR_1	MMRate	LR_1	MMRate	LR_1
15 - 19	0.00076	0.00381	0.00100	0.00498	0.00047	0.00237
20 - 24	0.00117	0.00584	0.00145	0.00727	0.00084	0.00418
25 - 29	0.00160	0.00798	0.00190	0.00949	0.00125	0.00627
30 - 34	0.00187	0.00934	0.00219	0.01095	0.00149	0.00747
35 - 39	0.00148	0.00740	0.00172	0.00861	0.00116	0.00582
40 - 44	0.00105	0.00527	0.00125	0.00625	0.00077	0.00383
45 - 49	0.00062	0.00308	0.00069	0.00344	0.00051	0.00253
MMRate	0.00123		0.00148		0.00093	
GFR	0.178		0.200		0.151	
MMRatio	691.5		739.9		613.1	
$LR_{1\ (Per\ women)}$		0.0427		0.0510		0.0325
Per 1000 women		42.7		51.0		32.5
1 in every..		23.4		19.6		30.8

When competing causes of death are factored into the estimation (Table 2 & 3), the risk of death from a pregnancy-related cause drops to one in every 33 female infants. However, the rural-urban differential remains, with one in every 28 female infants born in rural and one in every 43 female infants born in urban areas at risk of a pregnancy-related death. Adolescents in

rural areas have twice the lifetime risk of their urban peers. The highest risk of pregnancy-related deaths is found among women aged 30-34 years in both urban and rural areas.

Table 2: Lifetime risk of dying of maternal causes (with competing causes considered) among a cohort of infant females (LR_2)

	Total			Rural			Urban		
Age Group	L_x	L_x/l_x	LR_2	L_x	L_x/l_x	LR_2	L_x	L_x/l_x	LR_2
15 - 19	406,873	4.069	0.00310	400,496	4.005	0.00399	417,094	4.171	0.00197
20 - 24	394,658	3.947	0.00461	388,211	3.882	0.00564	404,757	4.048	0.00338
25 - 29	376,219	3.762	0.00601	370,356	3.704	0.00703	385,278	3.853	0.00483
30 - 34	352,104	3.521	0.00658	347,661	3.477	0.00761	359,012	3.590	0.00537
35 - 39	326,330	3.263	0.00483	323,902	3.239	0.00558	330,278	3.303	0.00385
40 - 44	302,239	3.022	0.00319	301,829	3.018	0.00378	303,054	3.031	0.00232
45 - 49	279,544	2.795	0.00172	281,577	2.816	0.00194	276,348	2.763	0.00140
$LR_{1\ (Per\ women)}$			0.0300			0.0356			0.0231
Per 1000 women			30.0			35.6			23.1
1 in every..			33.3			28.1			43.2

Table 3: Adult llifetime risk of dying of maternal causes (with competing causes considered) among a cohort of adolescents aged 15 years (LR_3)

	Total			Rural			Urban		
Age Group	L_x	L_x/l_{15}	LR_3	L_x	L_x/l_{15}	LR_3	L_x	L_x/l_{15}	LR_3
15 - 19	406,873	4.943	0.00377	400,496	4.939	0.00492	417,094	4.946	0.00234
20 - 24	394,658	4.794	0.00560	388,211	4.788	0.00696	404,757	4.800	0.00401
25 - 29	376,219	4.570	0.00730	370,356	4.567	0.00866	385,278	4.569	0.00573
30 - 34	352,104	4.277	0.00799	347,661	4.287	0.00939	359,012	4.257	0.00636
35 - 39	326,330	3.964	0.00587	323,902	3.994	0.00688	330,278	3.917	0.00456
40 - 44	302,239	3.672	0.00387	301,829	3.722	0.00466	303,054	3.594	0.00275
45 - 49	279,544	3.396	0.00209	281,577	3.472	0.00239	276,348	3.277	0.00166
$LR_{1\ (Per\ women)}$			0.0365			0.0439			0.0274
Per 1000 women			36.5			43.9			27.4
1 in every..			27.4			22.8			36.5

The age specific risk of dying of a pregnancy-related cause as a percentage of overall risk of dying estimated by the life table probability of dying within a particular age group ($_nq_x$) was highest in adolescents for all the three estimates and declined with increase in age. The percentages were 16.6% (LR_1), 13.5% (LR_2) and 16.4% (LR_3) respectively. There were marked

rural-urban differentials in the probability percent share of risk of pregnancy-related death for adolescent females. In rural areas, the percent share among adolescent for the three estimates were 20.4% (LR_1), 16.4% (LR_2) and 20.2% (LR_3), while for urban, the corresponding percent shares were 11.0% (LR_1), 9.2% (LR_2) and 10.9% (LR_3) respectively.

Conclusion

Safe motherhood remains a distant reality for most women in Zambia. The risk of a pregnancy-related death is very high even when other causes of death are considered. Of the three estimates, LR_1 produced the highest overall lifetime risk of dying of pregnancy-related cause. By defination, this was not unexpected. LR_3, the adult lifetime risk fell in between LR_1 the estimate without competing causes of death and LR_2, the overall lifetime risk estimate that also took account of competing causes of death. Wilmoth (2009) recommends the use of LR_3 as a more robust estimate of lifetime risk when derived using age specific data. We agree with his recommendation based on our own estimations.

References

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