

# Estimation of Maternal Mortality using the Indirect Sisterhood Method in Three Communities in Kaduna State, Northern Nigeria

Hadiza Idris<sup>1</sup>, Cecilia Tyoder<sup>2</sup>, Clara Ejembi<sup>3</sup>, Kelly Taylor<sup>4</sup>

<sup>1</sup>Department of Obstetrics and Gynaecology, Ahmadu Bello University Teaching Hospital, Zaria; <sup>2</sup>Department of Human Geography, Ahmadu Bello University, Zaria; <sup>3</sup>Department of Community Medicine, Ahmadu Bello University, Zaria; <sup>4</sup>Center for AIDS Prevention Studies, University of California, San Francisco.

\*For Correspondence: Hadiza Idris. E-mail: dearhadiza@yahoo.co.uk.

## Abstract

The maternal mortality ratio (MMR) is a good indicator of national development but its calculation is challenging. Estimation can be expensive, labour-intensive and time consuming. Incomplete vital registration of maternal deaths further compounds the difficulty. This scenario necessitates the exploration of other means of estimating maternal mortality, usually indirect techniques. This study estimated the MMR, the percentage of deaths due to maternal causes, and the lifetime risk of maternal death in three rural communities in Zaria emirate, using the indirect sisterhood method. Respondents were mostly Hausa Muslim individuals from 15-49 years of age with a Quranic education. Maternal causes accounted for 46.8% of all deaths, with a 1:13 lifetime risk of dying from maternal causes, and an MMR of 1400 per 100,000 live births. Achieving the fifth MDG will require accurate estimates of maternal deaths. Community-based and survey-based methods such as the sisterhood method are valuable tool in rural area that lack reliable data (*Afr. J. Reprod. Health* 2010; 14[3]: 77-81).

## Résumé

**Evaluation de la mortalité maternelle à l'aide de la méthode des sœurs indirecte dans trois communautés dans l'état de Kaduna, au nord du Nigéria.** Le rapport de la mortalité maternelle (RRM) est un bon indice du développement national, mais son évaluation est difficile. L'évaluation peut être chère, à forte intensité de travail et prend beaucoup de temps. La difficulté est encore aggravée par l'inscription vitale incomplète des décès maternels. Ce scénario nécessite l'exploration d'autres moyens d'évaluer la mortalité maternelle, souvent des techniques indirectes. Cette étude a évalué, à l'aide de la méthode des sœurs, le RMM, le pourcentage de décès dû aux causes maternelles et le risque de toute la vie du décès maternels dans trois communautés rurales de l'émirat de Zaria. Les interrogées étaient, dans la plupart des cas, des Haoussas musulmanes âgées de 15 à 49 ans, ayant reçu une instruction coranique. Les causes maternelles ont été responsables de 46,8% de tous les décès, avec un risque de toute la vie de 1:13 de mourir des causes maternelles et un RMM de 1400 contre 100,000 naissances vivantes. L'accomplissement du cinquième OMD exigera des évaluations précises de décès maternels. Les méthodes basées sur la communauté et celles qui sont basées sur la méthode des sœurs sont des outils importants dans les milieux ruraux qui n'ont pas de données sûres (*Afr. J. Reprod. Health* 2010; 14[3]: 77-81).

---

Key words: Sisterhood method, maternal mortality, rural communities.

---

## Introduction

In 1987, the International Safe Motherhood Initiative (SMI) was launched in Nairobi, Kenya<sup>1</sup>. Since the launch of the SMI, Nigeria ranked among countries that had struggled to attain the safe motherhood objectives<sup>1</sup>. In September 2000, the world leaders established the Millennium Development Goals (MDGs) and stepped up the effort by broadening the strategy with a simultaneous confrontation of extreme poverty, hunger, disease, gender inequality, en-

vironmental degradation, unsafe drinking water and insanitary practices. MDG-5 set the goal of reducing maternal mortality of 1990 by 75% by 2015<sup>1</sup>. This has stimulated a search for improved methods of estimating maternal mortality in order to track progress towards the attainment of this goal. Maternal mortality estimation is rather difficult. Although this indicator can be calculated directly from data collected through vital statistics registrations, house-hold surveys or hospital studies, these all have data quality problems and are not even available in many

parts of this country<sup>3,4</sup>. Consequent to this, it has been difficult to track the progress of the MDG-5 or design safe motherhood interventions. In such circumstances, reliance on the use of population-based estimates has become imperative.

In developing countries, good vital statistics registration systems are rare. Official data are usually obtained from health service records, but in many parts of such countries only few women have access to health facilities for essentials like deliveries. Therefore, in developing countries, it is often necessary to conduct surveys to collect data. Although time and resource consuming, household surveys are useful means of providing estimation of maternal mortality in large populations. The most common of these population-based surveys are the Demographic and Health Surveys and similar household surveys<sup>1,2,3</sup>.

Though population-based estimates are crucial for measuring maternal mortality ratios, establishing a country-wide consensus has been difficult because of conflicting reports made by different surveys. The recent Nigerian Multiple Indicator Cluster Survey (MICS) estimated the Nigeria's MMR as 1100/100,000 in 2005<sup>6</sup>, whereas the National Demographic and Health Survey (NDHS) reported the MMR was 545 per 100,000 life births in 2008<sup>8</sup>. It is very doubtful that these differences were real over the time interval. These differences must have accrued from differences in methodology and illustrate the dilemma of workers desiring to use mortality data for programme design<sup>9</sup>. The search for improved methods of accurate data capture continue in these circumstances of absent vital registration, poor health facility utilization and record-keeping and considerable variation in major survey reports.

The advent of the 'sisterhood methods' has presented opportunities for improving the quality of maternal mortality data capture. These methods have been acclaimed for their inexpensiveness, ease of application simplicity and when used in surveys. This opportunity is here explored for the improved documentation of maternal mortality in this earlier documented high prevalent setting<sup>5,9</sup>.

This study aims to use the indirect sisterhood method to estimate the maternal mortality ratio, the percentage of death due to maternal causes, and the lifetime risk of maternal death in three rural communities in Zaria, in an effort to provide credible data that will inform local maternal and newborn health care improvement.

## Methods

The study was conducted in three rural communities outside Zaria, where the Population and Reproductive Health Partnership (PRHP) trains its fellows on practical community-based research methods (The PRHP is a partnership between some Nigerian re-

productive health researchers and their counterparts in the University of California, Berkeley). Ethical approval was obtained from both the Ethics Committees of Ahmadu Bello University Teaching Hospital (ABUTH) Zaria and University of Berkeley, California.

This study collected cross sectional descriptive data using the indirect sisterhood method. The three communities sampled included Dakace in Zaria Local Government Area (LGA), Shika-Dam in Sabon Gari LGA and Tsibiri in Giwa LGA with respective populations of 3471, 2660, and 1490. Their inhabitants are overwhelmingly of Hausa/Fulani ethnicity except for Dakace which has sizable population of Mangu extraction. Men and women aged 15-49 constituted the study population. With the exception of Dakace that has some agro-allied industries, the main occupations of people of these communities are peasant farming and cattle-rearing.

The sample size of respondents was calculated to be 1,900, based on the assumption of the proportion of respondents to maternal death questionnaire to be 45% and a tolerable error of 5%. In order to allow for the cluster sampling design effect, the value was rounded up to the next 1,000. The figure was increased by 10% for possible non- or poor-responses. The minimum sample size of 2,200 was computed. The sample size was proportionally allocated to the three communities based on their population sizes (Table 1).

The survey was simultaneously conducted over a six-day period, by 18 trained research assistants in the three communities. The total number of households was divided by the allotted sample size for each village to get the sampling interval. The starting household was derived by balloting to select a number, randomly, between one and the sampling interval. In each household, a maximum of two eligible females and the male household head were interviewed, after obtaining an informed consent. The questionnaires were initially pre-tested on the local residents of the communities. The questionnaires were translated into the local language for clarity of word meaning. A special focus was placed upon the term "sister", which is understood differently in different cultures. Where the respondents were literate, he or she signed the consent form, but where the respondents were illiterate, after obtaining permission, the interviewer signed the consent form and dated it. Previous research had established a standard set of questions used to determine the sisterhood method of maternal mortality estimation. These questions (below) were included in the questionnaire<sup>8</sup>.

1. How many sisters have you ever had, born to the same mother, who ever reached the age 15 (or who were ever married) including those who are now dead?

**Table 1.** Socio-demographic characteristics of the respondents in the three communities in Zaria (n=1926)

Socio-demographic characteristics	Frequency	Percentage
<b>Village</b>		
Dakace	1048	54.40
Tsibiri	445	23.10
Shika Dam	433	22.50
<b>Age group</b>		
15-19	81	4.21
20-24	260	13.50
25-29	334	17.34
30-34	414	21.50
35-39	301	15.63
40-44	261	13.55
45-49	275	14.27
<b>Ethnic group</b>		
Hausa	1432	74.40
Others	345	17.90
Fulani	123	6.40
Igbo	21	1.10
Yoruba	5	0.30
<b>Religion</b>		
Islam	1567	81.40
Christianity	358	18.60
Others	L	0.10
<b>Educational level</b>		
Quranic	1064	55.20
Informal	12	0.62
Primary	230	12.00
Secondary	451	23.40
Tertiary	152	8.00
Others	3	0.15
None	14	0.72
<b>Total</b>	<b>1926</b>	<b>100.0</b>

- How many of these sisters reaching age 15 are alive now?
- How many of these sisters are dead?
- How many of these dead sisters died during pregnancy or during childbirth, or during the six weeks after the end of the pregnancy?

Seventy questionnaires were discarded from the analysis due to incomplete data, constituting 3.5% of the total questionnaires. There were 1,092 females and 904 males, giving a total of 1,926 respondents. The data was analysed using SPSS version 17. The overall lifetime risk of dying of maternal causes was calculated using the formula;

$$q(w) = \frac{\sum ri}{\sum Bi}$$

Where  $ri$  equals the number of maternal deaths and  $Bi$  is the "sister units of risk of exposure" which is the number of ever married sisters multiplied by the adjustment factor. The adjustment factor is a con-

stant, reported in the standard guidelines for the sisterhood method calculations<sup>12</sup>.

In order to convert this to the more conventional measure of maternal mortality, the maternal mortality ratio (deaths per 100,000 live births), the probability of survival was calculated from the inverse of the lifetime risk of dying.

$$\text{Probability of survival} = 1 - \frac{\sum ri}{\sum Bi}$$

From that, maternal mortality ratio (MMR) was calculated using the formula:

$$\text{MMR} = 1 - (\text{probability of survival})^{1/\text{TFR}}$$

## Results

A total of 1,906 respondents were inter-viewed. The vast majority of respondents were Hausa (74%), and Muslims (81%). More than 50% of respondents' had only Quranic education with only 23% attaining secondary level education.

Table 2 displays the necessary data and the steps involved in the calculation of the lifetime risk of maternal mortality and the maternal mortality ratio from the sisterhood method<sup>1,3</sup>. The 1,906 respondents reported a total of 10,223 ever married sisters of which 706 had died. Maternal causes accounted for 46.8% of mortality for women in the reproductive age group (328/706). The life-time risk of maternal death was calculated to be 0.079 or 1:13 woman and the maternal mortality ratio of 0.0014 or 1400 per 100,000 live births.

## Discussion

In this survey, the maternal mortality ratio of 1400 per 100,000 live-births was high but consistent with studies on maternal mortality done in other parts of northern Nigeria<sup>11,12</sup>. This is however well above the recent national average of 545 maternal deaths per 100,000 live births<sup>6</sup>. Although the latter report was not disaggregated to reveal state or zonal rates, successive national surveys had reported much higher maternal mortality ratios for the northern areas compared to the southern parts of Nigeria.

This survey was the first of its kind performed in this part of Nigeria using the sister-hood method. Since the survey communities did not have any previous data on maternal mortality, this survey served as a base line data. Reliable baseline data are crucial for tracking progress on outcomes of interventions and services effectively and assessing the pursuant of targets of efforts at reducing maternal mortality<sup>13</sup>.

Irrespective of what the maternal mortality might have been in the past, a ratio of 1400 per 100,000 live births, observed in these three communities, is unacceptable by present day standards. The causes of maternal deaths are well known, and so are their

**Table 2.** Analytical framework used to estimate maternal mortality and lifetime risk of maternal death in three communities in Zaria.

A	B	C	D	E	F	G	H	I	J
Age group of respondents =i	Number of respondents	Number of ever married sisters =Ni	Number of maternal deaths= ri	Number of deaths due to other causes	Total sisters dead	Proportion of maternal deaths (%)	** Adjustment factor =Ai	Sister units of risk of exposure =Bi=(i=Ni*Ai)	Lifetime risk of dying a maternal death D/I=ri/Bi=q(w)
15-19	81	782**	5	6	11	45.5	0.107	83	0.060
20-24	260	4407**	33	29	62	53.2	0.206	907	0.036
25-29	334	967	38	44	82	46.3	0.343	331	0.114
30-34	414	1374	87	79	166	52.4	0.503	691	0.125
35-39	301	969	54	51	105	51.4	0.664	643	0.083
40-44	261	919	59	81	140	42.1	0.802	737	0.080
45-49	275	810	52	88	140	37.1	0.900	727	0.071
<b>Total</b>	<b>1926</b>	<b>10228</b>	<b>328</b>	<b>378</b>	<b>706</b>	<b>46.8</b>		<b>4121</b>	<b>0.569</b>

\*\* Adjustment factors reproduced from a similar study<sup>12</sup>

remedies. Effective, in-expensive and implementable evidence-based interventions are now available, in the integrated maternal, newborn and child strategy (IMNCH), with which these deaths could be prevented. The advent of this initiative in 2005, its domestications for implementation in Nigeria in 2007 aroused hope that is obviously yet to be delivered to the inhabitants of these three rural communities studied. This call for an acceleration of the process of implementing the IMNCH strategy to go well beyond the urban areas and also reach women in the rural areas, failing which maternal mortality will remain or even climb in these places. Additionally, it will be necessary to also reduce in fertility, increase health care financing, availability of other resources for quality health service delivery and investment in human resource capacity building<sup>14</sup>.

The highest proportion of maternal deaths (compared to other deaths), was found in 20-24 year olds, with 53.2%. This may be because most of the respondents were in this age group

and that child bearing is also most frequent in the group, especially in these communities where early marriage is widely practiced<sup>6</sup>.

Most of the respondents had received only Quranic education, with only 8% attaining tertiary level education. In the event that this low educational level of these respondents reflected those of their deceased sisters, it will imply that illiteracy was a contributory factor to their demise as has been clearly shown by various studies<sup>1,2,5</sup>. Any effort at preventing maternal mortality in these communities must therefore address illiteracy by providing adult education for women and support girl-child education through improved enrolment and retention of girls in schools.

The main limitation of the sisterhood method of appraising maternal mortality lies in its capacity to capture retrospective rather than current events and estimates, as vital statistics registration would. Its use is therefore limited in circumstances where currency is necessary, as in the measurement of progress towards safe motherhood in the short term, evaluation of programme

impact or studying of trends and allocation of resources. However, in areas where inadequate or no data exist, it serves as a distant alternative for quantifying and characterizing maternal mortality in target areas.

The imprecision of MMR estimates obtained from a technique like this should not be a deterrent to action. Most estimates of maternal mortality in developing countries, regardless of their precision, uniformly show higher rates than is desired or tolerable and it is therefore needless to make excuses on imprecision in method of estimation. What is of utmost necessity is the avoidance of procrastination but commencement of swift and enduring interventions that will stem further loss of lives of women associated with pregnancy and childbirth.

## Conclusion

A high percentage of deaths of women of reproductive age are due to maternal causes with comparable higher maternal mortality ratio

than the national average. There are difficulties in measuring maternal mortality but the sisterhood method serves as a reliable and low cost survey method. It however has the limitation of providing only retrospective data for which it cannot be used for monitoring programmes. It nevertheless remains useful for use as base-line data and may be sufficient for comparing measurements, obtained every decade, of the general trend in maternal mortality.

## Acknowledgments

The authors would like to acknowledge the communities of Dakace, Shika Dam and Tsibiri for their participation. The authors would also like to thank the PRHP program at Ahmadu Bello University and the teaching hospital Zaria, the University of California, Berkeley and National Institute of Health, Fogarty International Centre and National Institute of Child Health and Development (5D43TW007696-04).

## References

1. Bankole A, Sedgh G, Okonofua F, Imarhiagbe C, Hussain R, D W. Barriers to safe motherhood in Nigeria. New York: *Guttmacher*; 2009
2. Danel I, Graham W, Stupp P, Castillo P. Applying the sisterhood method for estimating maternal mortality to a health facility-based sample: a comparison with results from a household-based sample. *Int. J. Epidemiol.* 1996 Oct; 25(5):1017-22.
3. F Font<sup>a</sup>, M Alonso González<sup>a</sup>, R Nathan<sup>b</sup>, F L willa<sup>b</sup>, J Kimario<sup>b</sup>, M Tanner<sup>c</sup> and PL Alonso<sup>a</sup>. Maternal Mortality in a rural district of southeastern Tanzania: an application of the sisterhood method. *Intl J. Epidemiol.* 2000;29:107-112.
4. Graham WJ, Ahmed S, Stanton C, Abou-Zahr CL, Campbell OMR. Measuring maternal mortality: An overview of opportunities and options for developing countries. *BMC Med.* 2008 May.6:12
5. Adegoke AA, Lawoyin TO, Ogundeji MO, Thomson AM. A community-based investigation of the avoidable factors of maternal mortality in Nigeria: the pilot experience. *Afr. Health Sci.* 2007 Sep; 7(3):176-81.
6. At a Glance Nigeria: MICS2005 Available at: [http://www.unicef.org/statistics/index\\_countrystatus.html](http://www.unicef.org/statistics/index_countrystatus.html)
7. Adamu YM, Salihu HM, Sathiakumar N, Alexander GR. Maternal mortality in Northern Nigeria: a population-based study. *Eur. J. Obstet. Gynecol. Reprod. Biol.* 2003 Aug 15; 109(2):153-9.
8. National Population Commission (NPC) [Nigeria] and ICF Macro. 2009. Nigeria Demographic and Health Survey 2008. Abuja, Nigeria: National Population Commission and ICF Macro
9. Jason B. S, Judith A. F, Emelita W, Ramesh A Nii A. C, Joseph de G J. Estimates of maternal mortality in the two districts of Brong-Ahafo region, Ghana. *Bull. WHO*, 2001, 79: 400–408.
10. WHO/UNICEF. The Sisterhood Method for Estimating Maternal Mortality: Guidance notes for potential users. 1997
11. Abubakar IS, Al Z, Daru HS, IC P. Estimation of maternal mortality using the indirect sisterhood methods in Plateau State, Nigeria. *Highland Med. Res. J.* 2003; 1(4).
12. Goni H. Estimation of maternal mortality in Fika LGA, Yobe state. MPH ABU Zaria; 2004.
13. O C, L F. Maternal mortality measurement resource-indirect sisterhood method. 2007 <http://www.maternal-mortality-measurement.org>.
14. First Northern Government Health Summit. Report of proceedings 2007.

